

# Marine Fish and Invertebrate Atlas: Summarizing Geographic Distribution and Population Indices in the Scotian Shelf and Bay of Fundy (1970-2020)

Daniel Ricard, Catalina Gomez, Jamie Emberley and Catriona Regnier-McKellar

Science Branch  
Gulf Region  
Fisheries and Oceans Canada  
Moncton, New Brunswick, E1C 5K4, Canada

Science Branch  
Maritimes Region  
Fisheries and Oceans Canada  
Dartmouth, Nova Scotia, B2Y 4A2, Canada

2021

Canadian Technical Report of  
Fisheries and Aquatic Sciences ####



Fisheries and Oceans  
Canada      Pêches et Océans  
Canada

Canada

## **Canadian Technical Report of Fisheries and Aquatic Sciences**

Technical reports contain scientific and technical information that contributes to existing knowledge but which is not normally appropriate for primary literature. Technical reports are directed primarily toward a worldwide audience and have an international distribution. No restriction is placed on subject matter and the series reflects the broad interests and policies of Fisheries and Oceans Canada, namely, fisheries and aquatic sciences.

Technical reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is abstracted in the data base *Aquatic Sciences and Fisheries Abstracts*.

Technical reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page.

Numbers 1-456 in this series were issued as Technical Reports of the Fisheries Research Board of Canada. Numbers 457-714 were issued as Department of the Environment, Fisheries and Marine Service, Research and Development Directorate Technical Reports. Numbers 715-924 were issued as Department of Fisheries and Environment, Fisheries and Marine Service Technical Reports. The current series name was changed with report number 925.

## **Rapport technique canadien des sciences halieutiques et aquatiques**

Les rapports techniques contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais qui ne sont pas normalement appropriés pour la publication dans un journal scientifique. Les rapports techniques sont destinés essentiellement à un public international et ils sont distribués à cet échelon. Il n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques de Pêches et Océans Canada, c'est-à-dire les sciences halieutiques et aquatiques.

Les rapports techniques peuvent être cités comme des publications à part entière. Le titre exact figure au-dessus du résumé de chaque rapport. Les rapports techniques sont résumés dans la base de données *Résumés des sciences aquatiques et halieutiques*.

Les rapports techniques sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre.

Les numéros 1 à 456 de cette série ont été publiés à titre de Rapports techniques de l'Office des recherches sur les pêcheries du Canada. Les numéros 457 à 714 sont parus à titre de Rapports techniques de la Direction générale de la recherche et du développement, Service des pêches et de la mer, ministère de l'Environnement. Les numéros 715 à 924 ont été publiés à titre de Rapports techniques du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 925.

Canadian Technical Report of  
Fisheries and Aquatic Sciences nnn

2021

5

MARINE FISH AND INVERTEBRATE ATLAS: GEOGRAPHIC DISTRIBUTION, POPULATION INDICES AND ENVIRONMENTAL PREFERENCES OF MARINE SPECIES IN THE SCOTIAN SHELF AND BAY OF FUNDY DERIVED FROM THE ANNUAL MARITIMES SUMMER SURVEY (1970-2020)

by

10

Daniel Ricard<sup>1</sup> Catalina Gomez<sup>2</sup> Jamie Emberley<sup>2</sup> Catriona Regnier-McKellar<sup>2</sup>

## **1 Science Branch**

## Gulf Region

Fisheries and Oceans Canada

Moncton, New Brunswick, E1C 5K4, Canada

^2Science Branch

## Maritimes Region

Fisheries and Oceans Canada

Dartmouth, Nova Scotia, B2Y 4A2, Canada

© Her Majesty the Queen in Right of Canada, 2021  
Cat. No. Fs97-6/nnnE-PDF ISBN ISSN 1488-5379

**22** Correct citation for this publication:

23 Ricard, D., Gomez, C., Emberley, J. and Regnier-McKellar, C. 2021. Marine Fish and  
24 Invertebrate Atlas: Geographic Distribution, Population Indices and Environmental Preferences  
25 of marine species in the Scotian Shelf and Bay of Fundy derived from the annual Maritimes  
26 Summer Survey (1970-2020). Can. Tech. Rep. Fish. Aquat. Sci. nnn: viii + 193 p.

# 27 CONTENTS

28	<b>ABSTRACT</b>	vii
29	<b>RÉSUMÉ</b>	viii
30	<b>1 Introduction</b>	1
31	<b>2 Methods</b>	1
32	2.1 Survey Description . . . . .	1
33	2.2 Sampling Design . . . . .	2
34	2.3 Taxonomic Levels . . . . .	6
35	2.4 Analyses . . . . .	15
36	2.4.1 Geographic distribution of catches . . . . .	15
37	2.4.2 Biomass indices . . . . .	15
38	2.4.3 Distribution indices . . . . .	15
39	2.4.4 Length frequencies . . . . .	15
40	2.4.5 Length-weight relationship and condition factor . . . . .	16
41	2.4.6 Depth, temperature and salinity distribution of catches . . . . .	16
42	2.4.7 Density-dependent habitat selection . . . . .	16
43	2.5 Description of Figures . . . . .	17
44	2.5.1 Type A . . . . .	17
45	2.5.2 Type B . . . . .	17
46	2.5.3 Type C. . . . .	17
47	2.5.4 Type D. . . . .	17
48	2.5.5 Type E. . . . .	18
49	2.5.6 Type F. . . . .	18
50	<b>3 Results</b>	18
51	3.1 Summary of successful tows by year and stratum . . . . .	18
52	3.2 Distribution of depth, bottom temperature and bottom salinity from survey tows . . . . .	23
53	3.2.1 Decadal distribution of surface and bottom temperatures . . . . .	23
54	<b>4 Discussion</b>	23
55	4.1 Diversity of approaches used for mapping fish and invertebrates in the Scotian	
56	Shelf bioregion . . . . .	23
57	4.2 Interpreting spatial results for marine spatial planning purposes . . . . .	25
58	<b>5 Acknowledgements</b>	26
59	<b>6 References</b>	29
60	<b>7 Appendix</b>	33
61	7.1 Atlantic cod (Morue franche) - species code 10 (category LF) . . . . .	34
62	7.2 Haddock (Aiglefin) - species code 11 (category LF) . . . . .	37
63	7.3 White hake (Merluche blanche) - species code 12 (category LF) . . . . .	40
64	7.4 Red hake (Merluche écureuil) - species code 13 (category LF) . . . . .	43
65	7.5 Silver hake (Merlu argenté) - species code 14 (category LF) . . . . .	46
66	7.6 Pollock (Goberge) - species code 16 (category LF) . . . . .	49

67	7.7	Atlantic redfishes (Sébastes de l'Atlantique) - species code 23 (category LF) . . . . .	52
68	7.8	Atlantic halibut (Flétan de l'Atlantique) - species code 30 (category LF) . . . . .	55
69	7.9	American plaice (Plie canadienne) - species code 40 (category LF) . . . . .	58
70	7.10	Witch flounder (Plie grise) - species code 41 (category LF) . . . . .	61
71	7.11	Yellowtail flounder (Limande à queue jaune) - species code 42 (category LF) . . . . .	64
72	7.12	Winter flounder (Limande-plie rouge) - species code 43 (category LF) . . . . .	67
73	7.13	Atlantic wolffish (Loup atlantique) - species code 50 (category LF) . . . . .	70
74	7.14	Atlantic herring (Hareng de l'Atlantique) - species code 60 (category LF) . . . . .	73
75	7.15	Longhorn sculpin (Chabosseau à dix-huit épines) - species code 300 (category LF)	76
76	7.16	Moustache sculpin (Faux-trigle armé) - species code 304 (category LF) . . . . .	79
77	7.17	Sea raven (Hémithriptère atlantique) - species code 320 (category LF) . . . . .	82
78	7.18	Alligatorfish (Poisson-alligator atlantique) - species code 340 (category LF) . . . . .	85
79	7.19	Monkfish (Baudroie d'Amérique) - species code 400 (category LF) . . . . .	88
80	7.20	Ocean pout (Loquette d'Amérique) - species code 640 (category LF) . . . . .	91
81	7.21	Thorny skate (Raie épineuse) - species code 201 (category LF) . . . . .	94
82	7.22	Smooth skate (Raie lisse) - species code 202 (category LF) . . . . .	97
83	7.23	Winter skate (Raie tachetée) - species code 204 (category LF) . . . . .	100
84	7.24	Picked dogfish (Aiguillat commun) - species code 220 (category LF) . . . . .	103
85	7.25	Northern shortfin squid (Encornet rouge nordique) - species code 4511 (category LF) . . . . .	106
87	7.26	Atlantic hagfish (Myxine du nord) - species code 241 (category LI) . . . . .	109
88	7.27	Cusk (Brosme) - species code 15 (category LI) . . . . .	110
89	7.28	Greenland halibut (Flétan noir) - species code 31 (category LI) . . . . .	111
90	7.29	Gulf Stream flounder (Plie du Gulf Stream) - species code 44 (category LI) . . . . .	112
91	7.30	American shad (Alose savoureuse) - species code 61 (category LI) . . . . .	113
92	7.31	Alewife (Gaspareau) - species code 62 (category LI) . . . . .	114
93	7.32	Capelin (Capelan) - species code 64 (category LI) . . . . .	115
94	7.33	Atlantic mackerel (Maquereau commun) - species code 70 (category LI) . . . . .	116
95	7.34	Longfin hake (Merluche à longues nageoires) - species code 112 (category LI) . . . . .	117
96	7.35	Fourbeard rockling (Motelle à quatre barbillons) - species code 114 (category LI) . . . . .	118
97	7.36	Blackbelly rosefish (Sébaste chèvre) - species code 123 (category LI) . . . . .	119
98	7.37	Greater argentine (Grande argentine) - species code 160 (category LI) . . . . .	120
99	7.38	Arctic hookear sculpin (Hameçon neigeux) - species code 306 (category LI) . . . . .	121
100	7.39	Atlantic poacher (Agone atlantique) - species code 350 (category LI) . . . . .	122
101	7.40	Marlin-spike grenadier (Grenadier du Grand Banc) - species code 410 (category LI) . . . . .	123
102	7.41	Lumpfish (Lompe) - species code 501 (category LI) . . . . .	124
103	7.42	Atlantic spiny lumpsucker (Petite poule de mer atlantique) - species code 502 (category LI) . . . . .	125
104	7.43	Sand lance (Lançon) - species code 610 (category LI) . . . . .	126
106	7.44	Snakeblenny (Lompénie-serpent) - species code 622 (category LI) . . . . .	127
107	7.45	Daubed shanny (Lompénie tachetée) - species code 623 (category LI) . . . . .	128
108	7.46	Vahl's eelpout (Lycode à carreaux) - species code 647 (category LI) . . . . .	129
109	7.47	Atlantic butterfish (Stromaté fossette) - species code 701 (category LI) . . . . .	130
110	7.48	Atlantic hookear sculpin (Hameçon atlantique) - species code 880 (category LI) . . . . .	131
111	7.49	Barndoor skate (Grande raie) - species code 200 (category LI) . . . . .	132
112	7.50	Little skate (Raie hérisson) - species code 203 (category LI) . . . . .	133
113	7.51	Northern prawn (Crevette nordique) - species code 2211 (category SF) . . . . .	134

114	7.52 Jonah crab (Tourteau jona) - species code 2511 (category SF) . . . . .	135
115	7.53 Atlantic rock crab (Tourteau poïnclos) - species code 2513 (category SF) . . . . .	136
116	7.54 Arctic lyre crab (Crabe Hyas coarctatus) - species code 2521 (category SF) . . . . .	137
117	7.55 Atlantic king crab (Crabe épineux du nord) - species code 2523 (category SF) . . . . .	138
118	7.56 Queen crab (Crabe des neiges) - species code 2526 (category SF) . . . . .	139
119	7.57 Great spider crab (Crabe lyre araignée) - species code 2527 (category SF) . . . . .	140
120	7.58 American lobster (Homard américain) - species code 2550 (category SF) . . . . .	141
121	7.59 Sea lamprey (Lamproie marine) - species code 240 (category LR) . . . . .	142
122	7.60 Atlantic tomcod (Poulamon atlantique) - species code 17 (category LR) . . . . .	143
123	7.61 Offshore silver hake (Merlu argenté du large) - species code 19 (category LR) . . . . .	144
124	7.62 Spotted wolffish (Loup tacheté) - species code 51 (category LR) . . . . .	145
125	7.63 Northern wolffish (Loup à tête large) - species code 52 (category LR) . . . . .	146
126	7.64 Rainbow smelt (Éperlan arc-en-ciel) - species code 63 (category LR) . . . . .	147
127	7.65 Cunner (Tanche-tautogue) - species code 122 (category LR) . . . . .	148
128	7.66 Fourspot flounder (Cardeau à quatre ocelles) - species code 142 (category LR) . . . . .	149
129	7.67 Windowpane flounder (Turbot de sable) - species code 143 (category LR) . . . . .	150
130	7.68 Longnose greeneye (Oeil-vert à long nez) - species code 149 (category LR) . . . . .	151
131	7.69 Lanternfishes (Poissons-lanternes) - species code 150 (category LR) . . . . .	152
132	7.70 Shortnose greeneye (Éperlan du large) - species code 156 (category LR) . . . . .	153
133	7.71 Silvery lightfish (Brossé améthyste) - species code 158 (category LR) . . . . .	154
134	7.72 Boa dragonfish (Dragon-boa) - species code 159 (category LR) . . . . .	155
135	7.73 Shorthorn sculpin (Chabosseau à épines courtes) - species code 301 (category LR) . . . . .	156
136	7.74 Grubby (Chabosseau bronzé) - species code 303 (category LR) . . . . .	157
137	7.75 Polar sculpin (Cotte polaire) - species code 307 (category LR) . . . . .	158
138	7.76 Spatulate sculpin (Icèle spatulée) - species code 314 (category LR) . . . . .	159
139	7.77 Arctic alligatorfish (Poisson-alligator arctique) - species code 341 (category LR) . . . . .	160
140	7.78 Alligatorfishes (Poissons-alligator) - species code 351 (category LR) . . . . .	161
141	7.79 Roughnose grenadier (Grenadier-scie) - species code 412 (category LR) . . . . .	162
142	7.80 Roundnose grenadier (Grenadier de roche) - species code 414 (category LR) . . . . .	163
143	7.81 Atlantic seasnail (Limace atlantique) - species code 503 (category LR) . . . . .	164
144	7.82 Gelatinous snailfish (Limace gélantineuse) - species code 505 (category LR) . . . . .	165
145	7.83 Variegated snailfish (Limace marbée) - species code 512 (category LR) . . . . .	166
146	7.84 Sea tadpole (Petite limace de mer) - species code 520 (category LR) . . . . .	167
147	7.85 Wolf eelpout (Lycode à tête longue) - species code 603 (category LR) . . . . .	168
148	7.86 Slender snipe eel (Avocette ruban) - species code 604 (category LR) . . . . .	169
149	7.87 Newfoundland eelpout (Lycode du Labrador) - species code 619 (category LR) . . . . .	170
150	7.88 Newfoundland eelpout (Lycode du Labrador) - species code 620 (category LR) . . . . .	171
151	7.89 Rock gunnel (Sigouine de roche) - species code 621 (category LR) . . . . .	172
152	7.90 Radiated shanny (Ulvaire deux-lignes) - species code 625 (category LR) . . . . .	173
153	7.91 Fourline snakeblenny (Quatre-lignes atlantique) - species code 626 (category LR) . . . . .	174
154	7.92 Wrymouth (Terrassier tacheté) - species code 630 (category LR) . . . . .	175
155	7.93 Spotfin dragonet (Dragonnet tacheté) - species code 637 (category LR) . . . . .	176
156	7.94 Arctic eelpout (Lycode arctique) - species code 641 (category LR) . . . . .	177
157	7.95 Atlantic soft pout (Molasse atlantique) - species code 646 (category LR) . . . . .	178
158	7.96 Silvery John dory (Saint Pierre argenté) - species code 704 (category LR) . . . . .	179
159	7.97 White barracudina (Lussion blanc) - species code 712 (category LR) . . . . .	180
160	7.98 Atlantic saury (Balaou atlantique) - species code 720 (category LR) . . . . .	181

161	7.99 Hatchetfishes (Haches d'argent) - species code 741 (category LR) . . . . .	182
162	7.100 Atlantic batfish (Malthe atlantique) - species code 742 (category LR) . . . . .	183
163	7.101 Spottedfin tonguefish (Langue fil noir) - species code 816 (category LR) . . . . .	184
164	7.102 Black dogfish (Aiguillat noir) - species code 221 (category LR) . . . . .	185
165	7.103 Longfin inshore squid (Calmar totam) - species code 4512 (category LR) . . . . .	186
166	7.104 Red deepsea crab (Crabe rouge) - species code 2532 (category SR) . . . . .	187
167	<b>INDEX</b>	<b>188</b>

## ABSTRACT

169 Ricard, D., Gomez, C., Emberley, J. and Regnier-McKellar, C. 2021. Marine Fish and  
170 Invertebrate Atlas: Geographic Distribution, Population Indices and Environmental Preferences  
171 of marine species in the Scotian Shelf and Bay of Fundy derived from the annual Maritimes  
172 Summer Survey (1970-2020). Can. Tech. Rep. Fish. Aquat. Sci. nnn: viii + 193 p.

173 The summer groundfish research vessel survey on the Scotian Shelf and in the Bay of  
174 Fundy started in 1970 and was designed to measure the distribution and abundance of  
175 major commercial fish species. Over time, additional information on non-commercial species  
176 was collected, and allowed considerable insight into ecosystem function and structure, as  
177 documented in many primary publications whose analyses used the survey data. The same  
178 groundfish survey database has also been used to produce species status reports, atlases of  
179 species distribution and remains an essential source of information for stock assessments in the  
180 Maritimes Region of Fisheries and Oceans Canada. This report builds on previous work and  
181 former atlases by updating a comprehensive suite of indices to assess population status and  
182 environmental preferences of 104 species. For each species, trends in geographic distribution  
183 and biomass or abundance were plotted. The spatial extent of distribution was plotted over  
184 time to gauge how the area occupied has changed. The relationship between abundance or  
185 biomass and spatial extent reflected whether the species distribution expands when abundance  
186 or biomass increases. Length frequencies over time depicted any changes in mean size. The  
187 plots of condition over time revealed whether individual fish are fatter or thinner than their long  
188 term mean. Depth, temperature and salinity preferences were estimated to gauge the range  
189 of suitable environmental parameters for each species. Finally, for each stratum, the slope  
190 describing how local density varies with regional abundance was estimated. The reproducible  
191 set of tools provided in this report constitutes a stepping stone to conduct other ecological  
192 analyses using the summer groundfish research vessel survey data by fostering reproducibility  
193 and transparency of ecological information collected and reported annually. Recognizing the  
194 diversity of approaches for visualizing and mapping fish and invertebrates in the Scotian Shelf  
195 bioregion, we recommend the development of a regional community of practice to compare and  
196 evaluate approaches for mapping, interpolating and/or modelling fish and invertebrates so future  
197 publications and advice can lead to more comparable work and consistent science advice to  
198 support processes such as marine spatial planning.

## RÉSUMÉ

200 Ricard, D., Gomez, C., Emberley, J. and Regnier-McKellar, C. 2021. Marine Fish and  
201 Invertebrate Atlas: Geographic Distribution, Population Indices and Environmental Preferences  
202 of marine species in the Scotian Shelf and Bay of Fundy derived from the annual Maritimes  
203 Summer Survey (1970-2020). Can. Tech. Rep. Fish. Aquat. Sci. nnn: viii + 193 p.

204 Le relevé estival par navires de recherche sur le poisson de fond sur le plateau néo-écossais  
205 et dans la baie de Fundy a débuté en 1970 et visait à mesurer la répartition et l'abondance  
206 des principales espèces de poissons commerciales. Au fil du temps, des informations  
207 supplémentaires sur les espèces non commerciales ont été recueillies et ont permis de mieux  
208 comprendre la fonction et la structure de l'écosystème, comme le montrent de nombreuses  
209 publications primaires dont les analyses ont utilisé les données d'enquête. La même base  
210 de données sur les relevés du poisson de fond a également été utilisée pour produire des  
211 rapports sur la situation des espèces, des atlas de la répartition des espèces et demeure une  
212 source essentielle d'information pour les évaluations des stocks dans la région des Maritimes  
213 de Pêches et Océans Canada. Ce rapport s'appuie sur des travaux antérieurs et d'anciens  
214 atlas en mettant à jour une série complète d'indices pour évaluer l'état de la population et les  
215 préférences environnementales de 104 espèces. Pour chaque espèce, les tendances de la  
216 répartition géographique et de la biomasse ou de l'abondance ont été tracées. L'étendue spatiale  
217 de la distribution a été tracée au fil du temps pour évaluer comment la zone occupée a changé.  
218 La relation entre l'abondance ou la biomasse et l'étendue spatiale indique si la répartition  
219 des espèces augmente lorsque l'abondance ou la biomasse augmente. Les fréquences de  
220 longueur au fil du temps représentaient tout changement dans la taille moyenne. Les graphiques  
221 de l'état au fil du temps ont révélé si les poissons individuels sont plus gros ou plus minces  
222 que leur moyenne à long terme. Les préférences en matière de profondeur, de température  
223 et de salinité ont été estimées pour évaluer la gamme de paramètres environnementaux  
224 appropriés pour chaque espèce. Enfin, pour chaque strate, la pente décrivant comment la  
225 densité locale varie avec l'abondance régionale a été estimée. L'ensemble d'outils reproductibles  
226 fournis dans ce rapport constitue un tremplin pour effectuer d'autres analyses écologiques  
227 à l'aide des données du relevé estival des navires de recherche sur les poissons de fond  
228 en favorisant la reproductibilité et la transparence de l'information écologique recueillie et  
229 rapportée annuellement. Reconnaissant la diversité des approches de visualisation et de  
230 cartographie des poissons et des invertébrés dans la biorégion du plateau néo-écossais, nous  
231 recommandons le développement d'une communauté de pratique régionale pour comparer et  
232 évaluer les approches de cartographie, d'interpolation et / ou de modélisation des poissons  
233 et des invertébrés afin conduire à des travaux plus comparables et à des avis scientifiques  
234 cohérents pour soutenir des processus tels que la planification de l'espace marin.

235

## 1 Introduction

236 The summer (July-August) groundfish research vessel survey on the Scotian Shelf and in the  
237 Bay of Fundy was started in 1970 by Fisheries and Oceans Canada Maritimes Region. The  
238 survey was originally designed to measure the distribution and abundance of major commercial  
239 fish species. Over time, information on non-commercial species was also collected. The  
240 groundfish survey database storing the information collected during the annual survey provides  
241 the main source of fisheries-independent information for marine species in the region. This  
242 information is routinely used to support stock assessments, to produce species status reports  
243 and has been previously used to publish atlases of species distribution.

244 The current document is an update of an earlier report (Ricard and Shackell 2013) that built  
245 on former atlases by updating a comprehensive suite of derived indices for 104 species to  
246 assess population status and, when feasible, environmental preferences. The information  
247 collected during the survey is stored in a relational database management system archived  
248 at Fisheries and Oceans Canada Maritimes Region which contains detailed information about  
249 the sampling locations and the associated catch. Tow-level survey data is also publicly available  
250 from the Ocean Biogeographic Information System (DFO 2016) and from the Open data portal  
251 supported by the federal government (DFO 2021). The present atlas builds upon the work done  
252 by Fisheries and Oceans colleagues from the northern Gulf of St. Lawrence (Bourdages and  
253 Ouellet 2012), southern Gulf of St. Lawrence (Benoît et al. 2003) and on earlier work in the  
254 Scotian Shelf (Simon and Comeau 1994; Horsman and Shackell 2009).

255 To facilitate updates and foster collaboration on the analyses of the survey data, the computer  
256 code necessary to extract the data, to perform the analyses presented herein, and to reproduce  
257 and update the current document is made available in a git repository (Ricard and Gomez 2021).

258 The survey area covers three major Northwest Atlantic Fisheries Organization (NAFO) zones  
259 that divide the Scotian Shelf into the colder east 4V and 4W (strata 440-466) and warmer  
260 west 4X (strata 470-495). For each species, temporal trends in geographic distribution and,  
261 when possible, biomass are plotted. Some caution is required in interpreting the results  
262 obtained for several taxa due to low sample size as explained later in the text. A full ecological  
263 interpretation of trends is beyond the scope of this report. Other documents stemming from peer-  
264 reviewed scientific processes under the auspices of the [Canadian Science Advisory Secretariat](#)  
265 (CSAS) provide further descriptions of spatio-temporal trends in different indicators and put the  
266 information collected during the summer groundfish research vessel survey in a more focused  
267 context (see for example Clark and Emberley (2011)).

268

## 2 Methods

### 269 2.1 Survey Description

270 The survey is conducted annually in July-August and covers the Scotian Shelf and the Bay of  
271 Fundy (Figure 2). It normally involves two separate two-week trips on board an offshore fisheries  
272 vessel from the Canadian Coast Guard.

273 A number of changes in fishing gear type and vessels used occurred since the onset of sampling  
274 activities (Clark and Emberley 2011). Comparative fishing experiments were conducted when  
275 those changes in survey platforms took place. A timeline of the survey platforms can be found in  
276 Figure 1.

277 In 2018, because of the unavailability of the CCGS Alfred Needler, only a partial survey coverage  
278 was achieved on CCGS Teleost and most of the strata in NAFO Division 4VW were not sampled.

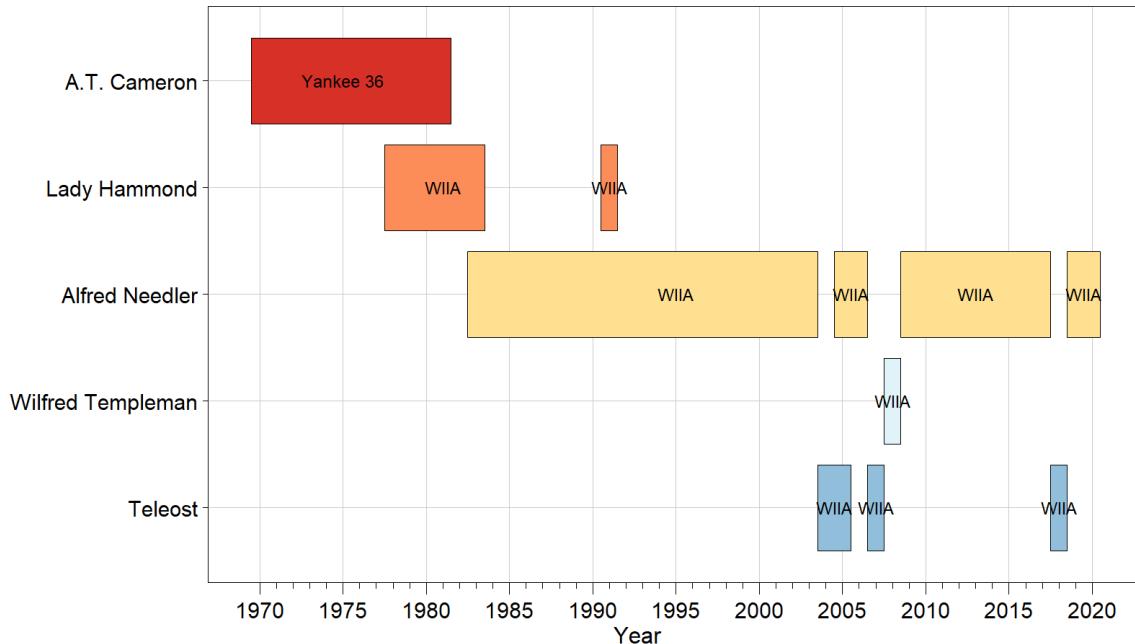


Figure 1. Timeline of survey platforms used in the Maritimes Region summer survey. The x axis denotes the timespan of the survey. The y axis identifies the vessel on which survey sets were conducted. The type of fishing gear deployed is overlaid on the polygon representing the time window when each vessel was used (WIIA is the Western IIA trawl).

## 279 2.2 Sampling Design

280 The summer survey covers divisions 4V, 4W and 4X of the Northwest Atlantic Fisheries  
281 Organization (NAFO) which includes the Scotian Shelf and the Bay of Fundy. The eastern limit of  
282 the survey is the Laurentian Channel and the western limit is the Fundian Channel (Figure 2).

283 The survey follows a stratified random design (Doubleday and Rivard 1981; Lohr 1999)  
284 (Figure 3). The number of tows conducted in each stratum is approximately proportional to the  
285 surface area of the stratum. The targeted area covered by the survey has remained constant  
286 since its inception, with the exception of additional deeper strata that were only sampled a few  
287 times since 2000. Because the sampling of the deeper strata is opportunistic and irregular, the  
288 analyses presented herein only include strata 440 to 495 which cover NAFO Divisions 4V, 4W  
289 and 4X (Figure 3 and Table 1).

290 The basic sampling unit of the survey is a 30-minute fishing tow conducted at a speed of 3.5

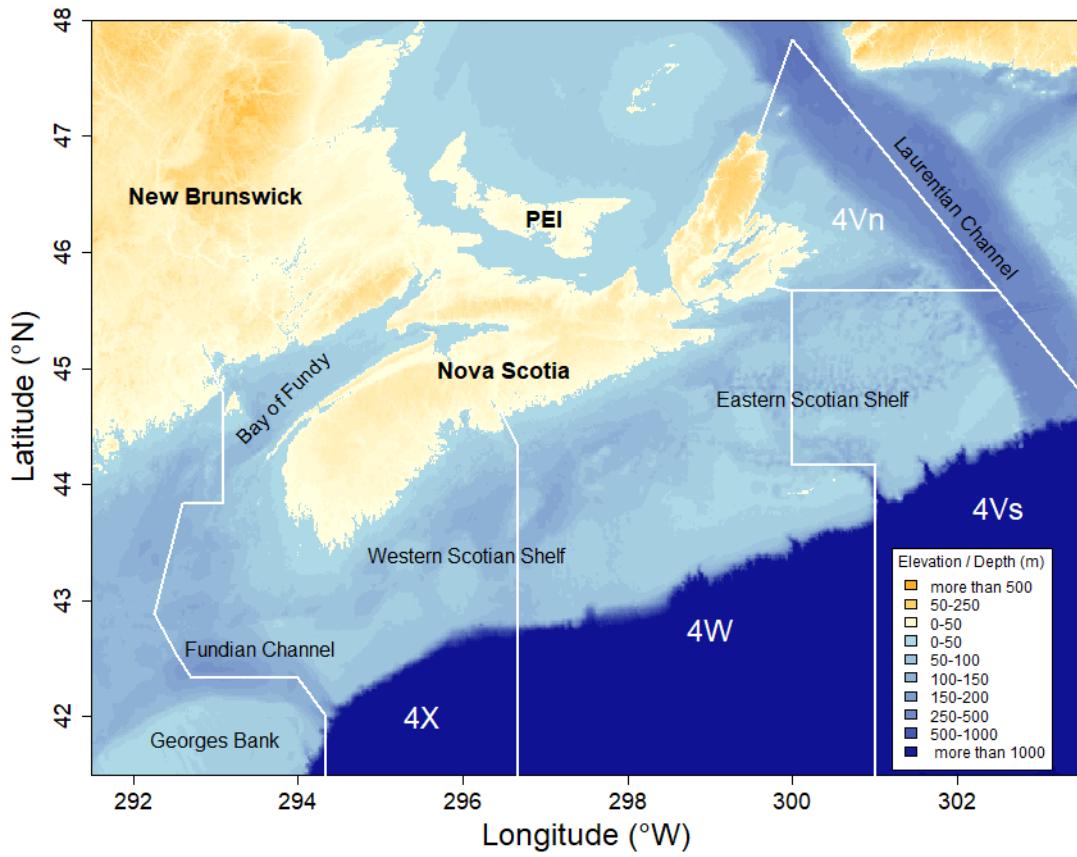


Figure 2. Map of the Scotian Shelf and Bay of Fundy where the DFO Maritimes summer survey takes place. The bathymetry presented here is the 15 arc-second gridded data set from the General Bathymetric Chart of the Oceans ([GEBCO](#)). Geographical locations of interest and the boundaries of relevant NAFO Divisions are also shown on the map.

<sup>291</sup> knots. This yields a distance towed of 1.75 nautical miles.

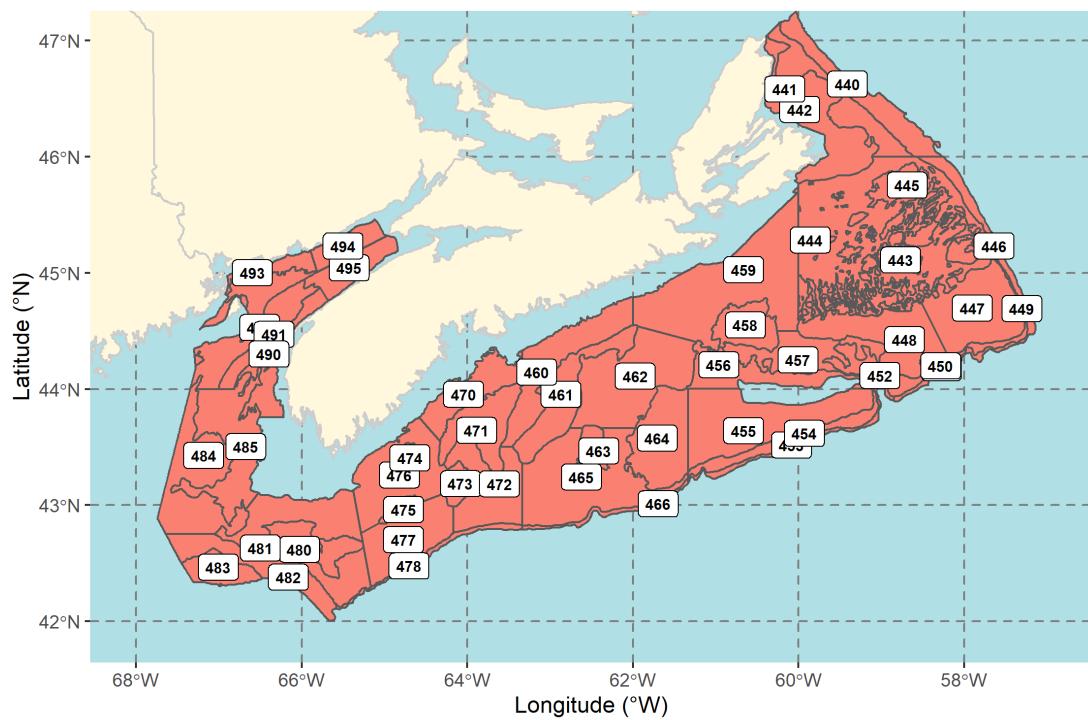


Figure 3. Map of the summer survey strata 440 to 495.

Table 1. Summer survey strata details. The strata used in the analyses are presented separately for NAFO Divisions 4Vn, 4VsW and 4X. For each stratum, the depth range in fathoms and the surface area in square kilometers are reported.

<b>NAFO Div.</b>	<b>Stratum</b>	<b>Depth range (fathom)</b>	<b>Area (km<sup>2</sup>)</b>
4Vn	440	101-200	924
	441	51-100	1000
	442	11-49	1437
4VsW	443	11-49	1318
	444	51-100	3925
	445	101-200	1023
	446	101-200	491
	447	11-49	1616
	448	11-49	1449
	449	51-100	144
	450	51-100	383
	451	101-200	147
	452	101-200	345
	453	101-200	259
	454	51-100	499
	455	11-49	2122
	456	11-49	955
	457	51-100	811
	458	11-49	658
	459	11-200	3148
	460	51-100	1344
	461	101-200	1154
	462	51-100	2116
	463	11-49	302
	464	11-50	1297
	465	51-100	2383
	466	101-200	226

NAFO Div.	Stratum	Depth range (fathom)	Area (km <sup>2</sup> )
4X	470	51-100	920
	471	101-200	1004
	472	51-100	1249
	473	11-49	265
	474	11-49	161
	475	11-49	156
	476	51-100	1478
	477	51-100	1232
	478	101-200	233
	480	11-49	655
	481	51-100	1875
	482	101-200	1042
	483	101-200	532
	484	101-200	2264
	485	51-100	1582
	490	11-49	601
	491	51-100	687
	492	51-100	1086
	493	11-49	533
	494	11-49	417
	495	11-49	584

292 After each tow the catch is sorted by species and weighed. Each fish caught is then measured,  
 293 and further sampling of individual fish weight, maturity status and age are performed for different  
 294 length classes. When catches exceed 300 individuals, a random sub-sample is used to obtain  
 295 the length and weight measurements.

### 296 2.3 Taxonomic Levels

297 Fish species caught during the surveys are identified by trained scientific personnel and their  
 298 scientific name is determined. An internal species code used in the relational database is  
 299 reported for each species (Losier and Waite 1989).

300 By its nature as a bottom trawl, the fishing gear used in the survey catches certain species  
 301 better than others. To ensure that meaningful ecological information can be extracted from  
 302 catch samples, we report the catch records for the subset of species that are caught reliably  
 303 by the gear. To appear in this atlas, a species must have had a minimum of 10 observations over  
 304 the duration of the survey activities. While both catch abundance and weight are recorded, the  
 305 weight of species that appear at low abundances is often recorded as zero in the earlier parts of  
 306 the survey when scales of appropriate precision were not available.

307 We divided the species caught into five categories based on 1) their taxonomic classification,

308 2) the number of recorded observations, and 3) their period of valid identification (Table 2).  
309 Category "LF", for "long frequent", was assigned to species that have more than 1000 records  
310 since 1970 and have been consistently identified since the onset of the survey. Category  
311 "LI", for "long intermediate", was assigned to species that had between 1000 and 200 catch  
312 records. Rare and elusive species (those with less than 200 catch records over the duration  
313 of the survey) are also reported but to a lower level of analytical details (Category "LR", for  
314 "long rare"). Category "SF", for "short frequent", was assigned to invertebrate species that were  
315 consistently sampled only since 1999 (Tremblay M. J. 2007). And category "SR", for "short rare"  
316 for invertebrate species consistently sampled only since 1999 and with less than 200 catch  
317 records. To ensure concordance with authoritative taxonomic information, the AphiaID from the  
318 World Register of Marine Species (Appeltans et al. 2012) is included for the different species  
319 presented in this document (Table 3) .

Table 2. Taxonomic levels used to determine the analytical treatment for each species.

<b>Category</b>	<b>Name</b>	<b>Description</b>
L	long - consistently identified since the onset of the survey in 1970	
LF	long frequent	species that have more than 1000 catch records
LI	long intermediate	species that had between 1000 and 200 catch records
LR	long rare	species with less than 200 catch records
S	short - invertebrate	species that were consistently sampled only since 1999
SF	short frequent	species with more than 200 catch records
SR	short rare	species with less than 200 catch records

Table 3. List of species included in the Atlas. For each taxonomic order and class, each species is listed in the table, its taxonomic family and scientific name is provided, along with its French and English common names, the species code used in the survey database, its AphiaID with a link to the World Registry of Marine Species, its number of catch records in the survey database and its classification category as defined in section 2.3.

	Family	Scientific name	English name	French name	Species code	AphiaID	Num. records	Category
<b>Actinopterygii</b>								
<i>Anguilliformes</i>								
	Nemichthyidae	<i>Nemichthys scolopaceus</i>	Slender snipe eel	Avocette ruban	604	<a href="#">126306</a>	28	LR
<i>Argentiniformes</i>								
	Argentinidae	<i>Argentina silus</i>	Greater argentine	Grande argentine	160	<a href="#">126715</a>	963	LI
<i>Aulopiformes</i>								
	Chlorophthalmidae	<i>Chlorophthalmus agassizi</i>	Shortnose greeneye	Éperlan du large	156	<a href="#">126336</a>	78	LR
		<i>Parasudis truculenta</i>	Longnose greeneye	Oeil-vert à long nez	149	<a href="#">158868</a>	45	LR
	Paralepididae	<i>Arctozenus risso</i>	White barracudina	Lussion blanc	712	<a href="#">126352</a>	196	LR
<i>Beloniformes</i>								
	Scomberesocidae	<i>Scomberesox saurus</i>	Atlantic saury	Balaou atlantique	720	<a href="#">126392</a>	37	LR
<i>Clupeiformes</i>								
	Clupeidae	<i>Alosa pseudoharengus</i>	Alewife	Gaspareau	62	<a href="#">158669</a>	977	LI
		<i>Alosa sapidissima</i>	American shad	Alose savoureuse	61	<a href="#">158670</a>	468	LI
		<i>Clupea harengus</i>	Atlantic herring	Hareng de l'Atlantique	60	<a href="#">126417</a>	3487	LF
<i>Gadiformes</i>								
	Gadidae	<i>Gadus morhua</i>	Atlantic cod	Morue franche	10	<a href="#">126436</a>	5451	LF
		<i>Melanogrammus aeglefinus</i>	Haddock	Aiglefin	11	<a href="#">126437</a>	5827	LF
		<i>Microgadus tomcod</i>	Atlantic tomcod	Poulamon atlantique	17	<a href="#">158928</a>	44	LR
		<i>Pollachius virens</i>	Pollock	Goberge	16	<a href="#">126441</a>	2787	LF
	Lotidae	<i>Brosme brosme</i>	Cusk	Brosme	15	<a href="#">126447</a>	688	LI

Class	Order	Family	Scientific name	English name	French name	Species code	AphiaID	Num. records	Category
Perciformes	Macrouridae		<i>Enchelyopus cimbricus</i>	Fourbeard rockling	Motelle à quatre barbillons	114	<a href="#">126450</a>	693	LI
			<i>Coryphaenoides rupestris</i>	Roundnose grenadier	Grenadier de roche	414	<a href="#">158960</a>	17	LR
			<i>Nezumia bairdii</i>	Marlin-spike grenadier	Grenadier du Grand Banc	410	<a href="#">183289</a>	529	LI
			<i>Trachyrincus murrayi</i>	Roughnose grenadier	Grenadier-scie	412	<a href="#">126481</a>	18	LR
	Merlucciidae		<i>Merluccius albidus</i>	Offshore silver hake	Merlu argenté du large	19	<a href="#">158748</a>	161	LR
			<i>Merluccius bilinearis</i>	Silver hake	Merlu argenté	14	<a href="#">158962</a>	4936	LF
	Phycidae		<i>Phycis chesteri</i>	Longfin hake	Merluche à longues nageoires	112	<a href="#">158988</a>	784	LI
			<i>Urophycis chuss</i>	Red hake	Merluche écureuil	13	<a href="#">126503</a>	2195	LF
			<i>Urophycis tenuis</i>	White hake	Merluche blanche	12	<a href="#">126504</a>	3524	LF
<i>Lophiiformes</i>	Lophiidae	<i>Lophius americanus</i>	Monkfish	Baudroie d'Amérique	400	<a href="#">159184</a>	1970	LF	
	Ogcocephalidae	<i>Dibranchus atlanticus</i>	Atlantic batfish	Malthe atlantique	742	<a href="#">126558</a>	18	LR	
	Myctophidae	<i>Myctophidae</i>	Lanternfishes	Poissons-lanternes	150	<a href="#">125498</a>	160	LR	
<i>Osmeriformes</i>	Osmeridae		<i>Mallotus villosus</i>	Capelin	Capelan	64	<a href="#">126735</a>	540	LI
			<i>Osmerus mordax</i>	Rainbow smelt	Éperlan arc-en-ciel	63	<a href="#">126737</a>	59	LR
	Ammodytidae	<i>Ammodytes dubius</i>	Sand lance	Lançon	610	<a href="#">151520</a>	1283	LI	
<i>Anarhichadidae</i>			<i>Anarhichas denticulatus</i>	Northern wolffish	Loup à tête large	52	<a href="#">126757</a>	17	LR
			<i>Anarhichas lupus</i>	Atlantic wolffish	Loup atlantique	50	<a href="#">126758</a>	1572	LF

Class	Order	Family	Scientific name	English name	French name	Species code	AphiaID	Num. records	Category
			<i>Anarhichas minor</i>	Spotted wolffish	Loup tacheté	51	<a href="#">126759</a>	20	LR
		Callionymidae	<i>Foetorepus agassizii</i>	Spotfin dragonet	Dragonnet tacheté	637	<a href="#">276339</a>	20	LR
		Cryptacanthodidae	<i>Cryptacanthodes maculatus</i>	Wrymouth	Terrassier tacheté	630	<a href="#">159675</a>	120	LR
		Labridae	<i>Tautogolabrus adspersus</i>	Cunner	Tanche-tautogue	122	<a href="#">159785</a>	82	LR
		Pholidae	<i>Pholis gunnellus</i>	Rock gunnel	Sigouine de roche	621	<a href="#">126996</a>	21	LR
		Scombridae	<i>Scomber scombrus</i>	Atlantic mackerel	Maquereau commun	70	<a href="#">127023</a>	696	LI
		Stichaeidae	<i>Eumesogrammus praecisus</i>	Fourline snakeblenny	Quatre-lignes atlantique	626	<a href="#">159817</a>	40	LR
			<i>Leptoclinus maculatus</i>	Daubed shanny	Lompénie tachetée	623	<a href="#">127072</a>	443	LI
			<i>Lumpenus lampretaeformis</i>	Snakeblenny	Lompénie-serpent	622	<a href="#">154675</a>	423	LI
			<i>Ulvaria subbifurcata</i>	Radiated shanny	Ulvaire deux-lignes	625	<a href="#">159821</a>	145	LR
		Stromateidae	<i>Peprilus triacanthus</i>	Atlantic butterfish	Stromaté fossette	701	<a href="#">159828</a>	487	LI
		Zoarcidae	<i>Lycenchelys verrillii</i>	Wolf eelpout	Lycode à tête longue	603	<a href="#">159258</a>	40	LR
			<i>Lycodes lavalaei</i>	Newfoundland eelpout	Lycode du Labrador	620	<a href="#">127107</a>	72	LR
			<i>Lycodes reticulatus</i>	Arctic eelpout	Lycode arctique	641	<a href="#">127112</a>	70	LR
			<i>Lycodes terraenovae</i>	Newfoundland eelpout	Lycode du Labrador	619	<a href="#">127117</a>	64	LR
			<i>Lycodes vahlii</i>	Vahl's eelpout	Lycode à carreaux	647	<a href="#">127118</a>	565	LI
			<i>Melanostigma atlanticum</i>	Atlantic soft pout	Molasse atlantique	646	<a href="#">127120</a>	43	LR
			<i>Zoarces americanus</i>	Ocean pout	Loquette d'Amérique	640	<a href="#">159267</a>	1478	LF
<i>Pleuronectiformes</i>		Cynoglossidae	<i>Syphurus diomedeanus</i>	Spottedfin tonguefish	Langue fil noir	816	<a href="#">159358</a>	24	LR

Class	Order	Family	Scientific name	English name	French name	Species code	AphiaID	Num. records	Category
		Paralichthyidae	<i>Citharichthys arctifrons</i>	Gulf Stream flounder	Plie du Gulf Stream	44	<a href="#">158791</a>	382	LI
			<i>Hippoglossina oblonga</i>	Fourspot flounder	Cardeau à quatre ocelles	142	<a href="#">158833</a>	76	LR
		Pleuronectidae	<i>Glyptocephalus cynoglossus</i>	Witch flounder	Plie grise	41	<a href="#">127136</a>	4301	LF
			<i>Hippoglossoides platessoides</i>	American plaice	Plie canadienne	40	<a href="#">127137</a>	6023	LF
			<i>Hippoglossus hippoglossus</i>	Atlantic halibut	Flétan de l'Atlantique	30	<a href="#">127138</a>	1634	LF
			<i>Limanda ferruginea</i>	Yellowtail flounder	Limande à queue jaune	42	<a href="#">158879</a>	3233	LF
			<i>Pseudopleuronectes americanus</i>	Winter flounder	Limande-plie rouge	43	<a href="#">158885</a>	1632	LF
			<i>Reinhardtius hippoglossoides</i>	Greenland halibut	Flétan noir	31	<a href="#">127144</a>	736	LI
		Scophthalmidae	<i>Scophthalmus aquosus</i>	Windowpane flounder	Turbot de sable	143	<a href="#">158907</a>	115	LR
Scorpaeniformes	Agonidae		<i>Agonidae</i>	Alligatorfishes	Poissons-alligator	351	<a href="#">125588</a>	43	LR
			<i>Aspidophoroides monopterygius</i>	Alligatorfish	Poisson-alligator atlantique	340	<a href="#">159459</a>	1029	LF
			<i>Leptagonus decagonus</i>	Atlantic poacher	Agone atlantique	350	<a href="#">127191</a>	266	LI
			<i>Ulcina olrikii</i>	Arctic alligatorfish	Poisson-alligator arctique	341	<a href="#">274356</a>	13	LR
	Cottidae		<i>Artediellus atlanticus</i>	Atlantic hookear sculpin	Hameçon atlantique	880	<a href="#">127193</a>	258	LI
			<i>Artediellus uncinatus</i>	Arctic hookear sculpin	Hameçon neigeux	306	<a href="#">127195</a>	306	LI

Class	Order	Family	Scientific name	English name	French name	Species code	AphiaID	Num. records	Category
Perciformes	Triglidae		<i>Icelus spatula</i>	Spatulate sculpin	lcèle spatulée	314	127200	40	LR
			<i>Myoxocephalus aenaeus</i>	Grubby	Chabosseau bronzé	303	159519	40	LR
			<i>Myoxocephalus octodecemspinosus</i>	Longhorn sculpin	Chabosseau à dix-huit épines	300	159520	3292	LF
			<i>Myoxocephalus scorpius</i>	Shorthorn sculpin	Chabosseau à épines courtes	301	127203	131	LR
			<i>Triglops murrayi</i>	Moustache sculpin	Faux-trigle armé	304	127205	1182	LF
	Cyclopteridae		<i>Cyclopterus lumpus</i>	Lumpfish	Lompe	501	127214	216	LI
			<i>Eumicrotremus spinosus</i>	Atlantic spiny lumpucker	Petite poule de mer atlantique	502	127217	226	LI
	Hemitripteridae		<i>Hemitripterus americanus</i>	Sea raven	Hémithriptère atlantique	320	159518	2126	LF
	Liparidae		<i>Careproctus reinhardtii</i>	Sea tadpole	Petite limace de mer	520	127212	18	LR
			<i>Liparis atlanticus</i>	Atlantic seasnail	Limace atlantique	503	159524	34	LR
			<i>Liparis fabricii</i>	Gelatinous snailfish	Limace gélatineuse	505	127218	27	LR
			<i>Liparis gibbus</i>	Variegated snailfish	Limace marbée	512	159526	41	LR
Stomiiformes	Psychrolutidae		<i>Cottunculus microps</i>	Polar sculpin	Cotte polaire	307	127235	29	LR
	Sebastidae		<i>Helicolenus dactylopterus</i>	Blackbelly rosefish	Sébaste chèvre	123	127251	610	LI
			<i>Sebastes</i>	Atlantic redfishes	Sébastes de l'Atlantique	23	126175	4152	LF
	Sternopychidae		<i>Maurolicus muelleri</i>	Silvery lightfish	Brossé améthyste	158	127312	52	LR
			<i>Sternopychidae</i>	Hatchetfishes	Haches d'argent	741	125603	21	LR
	Stomiidae		<i>Stomias boa</i>	Boa dragonfish	Dragon-boa	159	127374	20	LR
<i>Zeiformes</i>									

Class	Order	Family	Scientific name	English name	French name	Species code	AphiaID	Num. records	Category
		Zeidae	<i>Zenopsis conchifer</i>	Silvery John dory	Saint Pierre argenté	704	<a href="#">127426</a>	39	LR
<b>Cephalopoda</b>									
<i>Myopsida</i>									
		Loliginidae	<i>Doryteuthis pealeii</i>	Longfin inshore squid	Calmar totam	4512	<a href="#">574541</a>	96	LR
<i>Oegopsida</i>									
		Ommastrephidae	<i>Illex illecebrosus</i>	Northern shortfin squid	Encornet rouge nordique	4511	<a href="#">153087</a>	4836	LF
<b>Elasmobranchii</b>									
<i>Rajiformes</i>									
		Rajidae	<i>Amblyraja radiata</i>	Thorny skate	Raie épineuse	201	<a href="#">105865</a>	3937	LF
			<i>Dipturus laevis</i>	Barndoor skate	Grande raie	200	<a href="#">158548</a>	246	LI
			<i>Leucoraja erinacea</i>	Little skate	Raie hérisson	203	<a href="#">158551</a>	712	LI
			<i>Leucoraja ocellata</i>	Winter skate	Raie tachetée	204	<a href="#">158553</a>	1180	LF
			<i>Malacoraja senta</i>	Smooth skate	Raie lisse	202	<a href="#">158554</a>	1773	LF
<i>Squaliformes</i>									
		Etmopteridae	<i>Centroscyllium fabricii</i>	Black dogfish	Aiguillat noir	221	<a href="#">105906</a>	31	LR
		Squalidae	<i>Squalus acanthias</i>	Piked dogfish	Aiguillat commun	220	<a href="#">105923</a>	1985	LF
<b>Malacostraca</b>									
<i>Decapoda</i>									
		Cancridae	<i>Cancer borealis</i>	Jonah crab	Tourteau jona	2511	<a href="#">158056</a>	1387	SF
			<i>Cancer irroratus</i>	Atlantic rock crab	Tourteau poïnclos	2513	<a href="#">158057</a>	788	SF
		Geryonidae	<i>Chaceon quinquedens</i>	Red deepsea crab	Crabe rouge	2532	<a href="#">158407</a>	33	SR
		Lithodidae	<i>Lithodes maja</i>	Atlantic king crab	Crabe épineux du nord	2523	<a href="#">107205</a>	531	SF
		Nephropidae	<i>Homarus americanus</i>	American lobster	Homard américain	2550	<a href="#">156134</a>	1623	SF

Class	Order	Family	Scientific name	English name	French name	Species code	AphiaID	Num. records	Category
Oregoniidae			<i>Chionoecetes opilio</i>	Queen crab	Crabe des neiges	2526	<a href="#">107315</a>	1546	SF
			<i>Hyas araneus</i>	Great spider crab	Crabe lyre araignée	2527	<a href="#">107322</a>	625	SF
			<i>Hyas coarctatus</i>	Arctic lyre crab	Crabe Hyas coarctatus	2521	<a href="#">107323</a>	711	SF
		Pandalidae	<i>Pandalus borealis</i>	Northern prawn	Crevette nordique	2211	<a href="#">107649</a>	718	SF
<b>Myxini</b>									
<i>Myxiniformes</i>									
		Myxinidae	<i>Myxine glutinosa</i>	Atlantic hagfish	Myxine du nord	241	<a href="#">101170</a>	804	LI
<b>Petromyzonti</b>									
<i>Petromyzontiformes</i>									
		Petromyzontidae	<i>Petromyzon marinus</i>	Sea lamprey	Lamproie marine	240	<a href="#">101174</a>	16	LR

320 **2.4 Analyses**

321 The Oracle relational database where all survey data are stored and archived is accessible from  
322 the Bedford Institute of Oceanography in Dartmouth, Nova Scotia. Queries written in Structured  
323 Query Language (SQL) are used to extract the data from the production server and to create the  
324 data products used in all subsequent analyses. Catch records classified as "valid" (i.e. coming  
325 from a representative tow without damage to the net) are used in the current analyses. To make  
326 the available samples comparable, catch number and weight for each species was standardized  
327 for the distance towed.

328 All data processing and analyses were conducted using the R software (R Core Team 2020)  
329 using packages gstat (Pebesma 2004), PBSmapping (Schnute et al. 2019), RODBC (Ripley  
330 and Lapsley 2019), spatstat (Baddeley 2015), maptools (Bivand and Lewin-Koh 2020), rgeos  
331 (Bivand and Rundel 2020), classInt(Bivand 2020), RColorBrewer(Neuwirth 2014), MASS (Ripley  
332 et al. 2020), worms (Holstein 2018), and tidyverse (Wickham 2019). The present document is  
333 rendered as a Technical Report using the csasdown R package developed and maintained by  
334 Fisheries and Oceans Canada scientists (Anderson et al. 2021).

335 **2.4.1 Geographic distribution of catches**

336 Spatial interpolation of catch biomass (kg/tow) was done using a weighting inversely proportional  
337 to the distance (inverse-distance weighted, IDW), using function "idw" of the spatstat R package  
338 (Baddeley 2015). The IDW method was used with a power parameter value of 10.

339 **2.4.2 Biomass indices**

340 For each species, stratified random estimates of catch biomass (Smith 1996) were computed for  
341 each year. Yearly estimates of the standard error were also computed.

342 **2.4.3 Distribution indices**

343 For each Category L, I and S fish species, the minimum area required to account for 75% and  
344 95% of the total biomass were computed (D75% and D95%). These measures of distributions  
345 were computed for each year by using the Lorenz curve of mean stratum-level catch estimates  
346 and the area of occupied strata (Swain and Sinclair 1994; Swain and Morin 1996).

347 **2.4.4 Length frequencies**

348 The length frequency distribution of catch (the stratified numbers-at-length) is tabulated for each  
349 seven-year period (1970-2009), and last ten-year period (2010-2020).

350 **2.4.5 Length-weight relationship and condition factor**

351 The relationship between the weight and the length of fish was estimated using the following  
352 non-linear isometric relationship:

$$W = \alpha L^\beta$$

353 where W is the total weight (g), L is the length (cm), and,  $\alpha$  and  $\beta$  are the parameters to be  
354 estimated.

355 Average fish condition (C) was computed as:

$$C = \frac{W}{\alpha L^\beta}$$

356

357 **2.4.6 Depth, temperature and salinity distribution of catches**

358 For each category L species, We followed the methods developed by (Perry and Smith 1994)  
359 and generated cumulative frequency distributions of depth, temperature and salinity of survey  
360 catches.

361 **2.4.7 Density-dependent habitat selection**

362 We followed the methods of (Myers and Stokes 1989) to evaluate how fish abundance in each  
363 stratum varied with overall temporal fluctuations of population abundance.

364 For each category L species, we fitted a model of the relationship between stratum-level density  
365 and overall abundance (the yearly stratified random estimate of abundance, defined above).  
366 To properly use the observations of zero catch while accounting for the logarithmic distribution  
367 of catch abundance, we implemented the model as a generalised linear using a log link and a  
368 Poisson error distribution:

$$Y_{h,i} = \alpha_{h,i} Y_i^{\beta_{h,i}}$$

369 where,  $y_{h,i}$  is the average abundance of stratum  $h$  in year  $i$ , and  $\alpha_{h,i}$  and  $\beta_{h,i}$  are the fitted  
370 parameters. The estimated parameter  $\beta_{h,i}$  is referred to as the “slope parameter” and indicates  
371 whether stratum-level density is positively ( $\beta_{h,i} <= 0$ ), negatively ( $\beta_{h,i} >= 0$ ) or negligibly  
372 ( $\beta_{h,i} \approx 0$ ) related to population abundance.

373 To estimate the suitability of each stratum, the median abundance observed during the years  
374 that are in the top 25% of yearly estimates is used. We combine the slope parameter estimates  
375 from the above model with the median abundance to identify strata that have consistently high  
376 abundance and whose local density is weakly related to fluctuation in population abundance  
377 ( $\beta_{h,i} \approx 0$ ). Preferred strata are identified for each category L species.

378 **2.5 Description of Figures**

379 **2.5.1 Type A**

380 For Category L and S species:

381 Spatial distribution of catch-per unit of effort, (CPUE, kilograms per tow) in July-August for the  
382 Bay of Fundy and Scotian Shelf in five-year periods. Spatial interpolation between tows was  
383 done using Inverse Distance Weight (IDW). The probability of occurrence (proportion of tows with  
384 catch records for a given species) was also reported for each five-year period.

385 For Category LR and SR:

386 Location of tows with catch over the period 1970-2020 (Type LR) or the period 1999-2020 (Type  
387 SR). Location of tows with catch over the period 1970-2020 (Type LR) or the period 1999-2020  
388 (Type SR).

389 **2.5.2 Type B**

390 For Category L, S and I species:

391 Stratified random estimate of CPUE (left panel), distribution indices (D75% and D95%, the  
392 minimum area containing 75% and 95% of biomass, middle panel), and distribution vs. weight  
393 per tow (right panel). The stratified random mean is plotted as a solid line with the 95%  
394 confidence region indicated by the solid grey line. The overall mean is plotted as a grey  
395 horizontal line and the overall mean plus or minus 50% of the standard deviation appear as  
396 horizontal dashed lines. In all three panels, the early years appear in blue and the last years  
397 appear in red. The predictions from a loess estimator are overlaid on the distribution indices  
398 (middle panel). The Pearson correlation coefficient between D75% and biomass, and its  
399 statistical significance, are also reported in the right panel.

400 **2.5.3 Type C.**

401 Length frequency distribution for NAFO divisions 4X and 4VW. A smoothed length frequency  
402 distribution is shown for each 7-year periods covered by the surveys.

403 **2.5.4 Type D.**

404 Average fish condition for all fish lengths (black dots and black line), large fish (thick gray line),  
405 and small fish (thin gray line). Fish condition is presented for NAFO divisions 4VW (right panel)  
406 and 4X (left panel).

407 **2.5.5 Type E.**

408 Cumulative frequency distributions of depth, temperature and salinity at all sampled locations  
409 (thick solid line) and at fishing locations with catch records (thin dashed line). The depth,  
410 temperature and salinity associated with 5%, 25%, 50%, 75% and 95% of the cumulative catch is  
411 shown in tabular fashion on the bottom right panel.

412 **2.5.6 Type F.**

413 Slopes estimates from the density-dependent habitat selection model (y axis) plotted versus  
414 the median abundance during the top 25% of years. The red box indicates strata of particular  
415 importance for a species by identifying slopes that are within a standard error from zero and that  
416 are within the top 25% of median abundance. Each stratum is identified on the plot by the last  
417 two digits of its number.

418 **3 Results**

419 The plots generated for each species are presented in the Appendix.

420 **3.1 Summary of successful tows by year and stratum**

421 A total of 9080 representative tows were conducted for the period spanning from 1970 to 2020  
422 (Figure 4).

423 Tables 4, 5 and 6 present the number of tows conducted in each stratum and year.

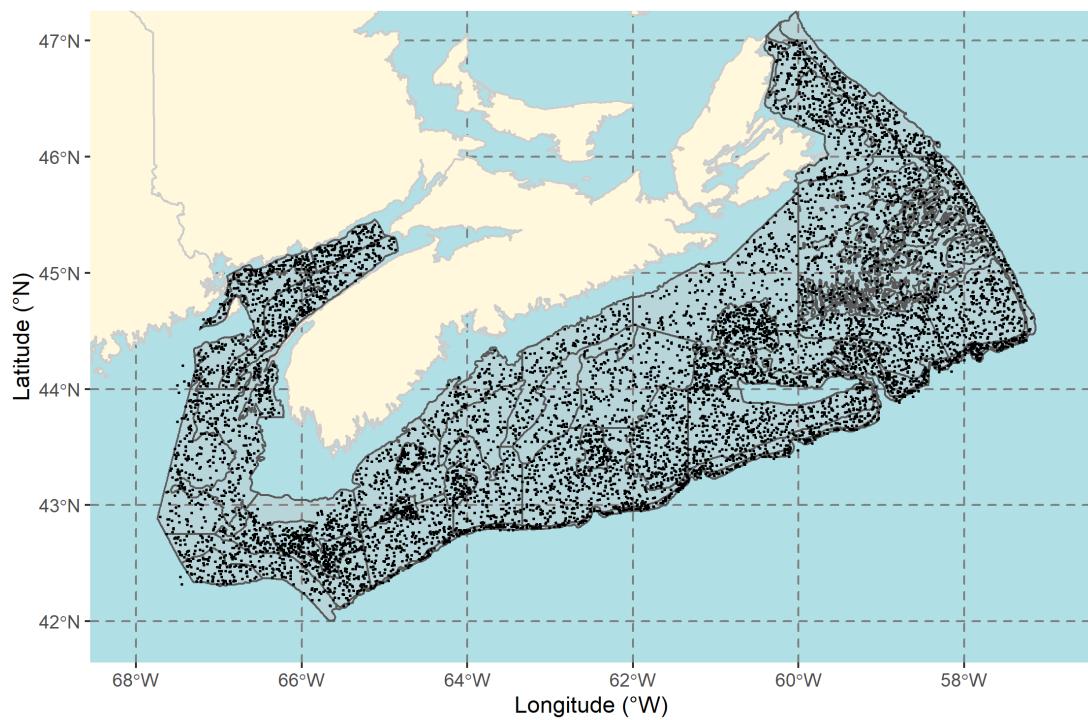


Figure 4. Map of the 9080 representative tows in the Summer survey from 1970 to 2020.

Table 4. Number of representative tows conducted in each stratum during the period 1970 to 1989.

Stratum	NAFO Div.	Area (km <sup>2</sup> )	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
440	4VN	3173.016	4	2	2	3	3	3	3	3	3	3	3	3	3	3	3	4	5	5	6	4
441	4VN	3434.000	4	2	2	3	3	3	1	3	3	3	3	3	3	3	3	5	5	4	4	4
442	4VN	4934.658	3	2	2	2	3	3	2	3	3	3	3	3	3	3	3	3	5	6	7	5
443	4VSW	4526.012	4	2	4	4	8	3	1	2	4	4	4	3	3	5	4	4	6	6	5	2
444	4VSW	13478.450	3	2	5	4	6	4	6	7	4	4	4	5	5	6	4	4	6	6	3	6
445	4VSW	3512.982	5	2	5	4	5	5	1	3	4	4	4	5	5	3	4	5	6	4	4	4
446	4VSW	1686.094	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3
447	4VSW	5549.344	4	2	6	5	7	4	4	3	4	4	4	5	4	4	4	4	5	7	6	6
448	4VSW	4975.866	5	2	5	4	5	4	4	4	4	4	4	4	6	4	4	4	5	5	5	5
449	4VSW	494.496	2	2	2	2	3	2	2	2	1	2	2	2	1	2	2	2	2	2	2	2
450	4VSW	1315.222	2	2	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
451	4VSW	504.798	1	2	2	2	2	2	2	2	2	3	2	2	3	2	2	2	2	2	2	2
452	4VSW	1184.730	2	2	2	2	2	2	2	2	2	2	2	4	2	2	2	2	2	2	2	2
453	4VSW	889.406	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2
454	4VSW	1713.566	3	2	3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2	2	2
455	4VSW	7286.948	7	6	7	6	7	6	6	7	7	7	7	7	7	7	7	8	7	7	7	7
456	4VSW	3279.470	5	4	6	5	5	6	4	6	6	6	7	6	6	6	6	6	7	6	6	6
457	4VSW	2784.974	2	2	2	2	3	2	2	2	2	2	2	3	2	2	2	2	2	4	2	2
458	4VSW	2259.572	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	5	5	3	3
459	4VSW	10810.232	3	2	4	4	4	4	4	4	4	4	4	4	3	4	4	6	6	5	6	5
460	4VSW	4615.296	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	4	3	3	3
461	4VSW	3962.836	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	2	2
462	4VSW	7266.344	3	3	4	3	4	4	4	4	4	4	4	6	4	4	4	4	6	5	4	4
463	4VSW	1037.068	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2
464	4VSW	4453.898	4	3	5	3	3	6	5	5	5	5	5	4	5	5	5	7	6	5	5	5
465	4VSW	8183.222	6	5	5	4	5	4	5	5	5	5	5	7	6	5	5	5	8	8	8	8
466	4VSW	776.084	2	2	3	2	3	3	3	3	3	3	3	2	3	3	3	3	3	2	2	2
470	4X	3159.280	1	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	3	3	3
471	4X	3447.736	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
472	4X	4289.066	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	4	4
473	4X	910.010	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
474	4X	552.874	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	2	2	2	2
475	4X	535.704	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
476	4X	5075.452	2	2	2	2	2	2	3	2	2	2	1	2	2	2	2	2	2	4	4	4
477	4X	4230.688	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	5	4	4
478	4X	800.122	2	2	3	2	3	3	3	3	2	3	3	3	3	3	3	3	3	2	2	2
480	4X	2249.270	4	4	4	3	3	3	4	4	3	4	3	3	4	4	4	4	4	4	4	4
481	4X	6438.750	5	3	4	4	4	3	4	4	5	4	3	4	4	4	4	4	4	6	7	6
482	4X	3578.228	2	1	2	2	2	2	3	2	2	3	2	2	2	2	2	2	2	3	3	3
483	4X	1826.888	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2
484	4X	7774.576	2	2	3	3	3	3	3	3	2	3	3	3	4	3	3	3	4	4	4	4
485	4X	5432.588	2	2	2	3	3	3	3	3	3	2	3	4	3	3	3	3	6	7	6	6
490	4X	2063.834	2	2	2	2	2	3	3	3	3	2	3	3	3	3	3	3	3	4	4	4
491	4X	2359.158	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4
492	4X	3729.324	3	2	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4
493	4X	1830.322	1	2	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3
494	4X	1431.978	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
495	4X	2005.456	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2
		171809.888	134	110	146	134	153	143	135	144	141	147	145	150	150	146	143	152	171	188	177	170

Table 5. Number of representative tows conducted in each stratum during the period 1990 to 2009.

Stratum	NAFO Div.	Area (km <sup>2</sup> )	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
440	4VN	3173.016	4	4	4	3	4	4	4	4	4	4	6	4	4	4	4	4	4	4	3	4	
441	4VN	3434.000	6	5	5	5	5	5	5	5	6	7	6	6	7	6	7	6	6	5	6		
442	4VN	4934.658	5	5	6	5	6	6	6	6	7	6	6	5	6	6	7	5	5	5	6		
443	4VSW	4526.012	4	2	4	3	3	4	4	5	5	4	4	5	5	5	5	4	4	4	5	4	
444	4VSW	13478.450	7	8	8	9	6	8	8	7	8	8	9	10	9	9	9	8	10	8	6	9	
445	4VSW	3512.982	4	4	4	5	7	4	4	4	3	3	6	5	5	5	5	6	5	4	3	6	
446	4VSW	1686.094	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	
447	4VSW	5549.344	8	7	7	7	7	7	6	7	7	6	7	7	7	7	7	7	6	6	4	6	
448	4VSW	4975.866	9	6	6	7	7	7	6	7	6	7	8	8	8	8	7	8	8	6	5	7	
449	4VSW	494.496	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	
450	4VSW	1315.222	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	
451	4VSW	504.798	2	2	2	2	2	2	4	2	2	2	2	2	2	2	2	2	2	2	2	2	
452	4VSW	1184.730	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
453	4VSW	889.406	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	
454	4VSW	1713.566	3	2	2	2	2	2	3	2	2	2	2	2	2	2	2	3	2	2	2	2	
455	4VSW	7286.948	12	10	10	9	10	10	10	13	8	11	11	11	11	11	8	12	11	7	5	8	
456	4VSW	3279.470	10	7	7	8	8	8	8	8	6	8	10	8	8	8	8	8	8	6	2	7	
457	4VSW	2784.974	4	2	2	2	2	2	2	2	1	4	2	2	2	2	2	2	2	2	2	2	
458	4VSW	2259.572	9	8	8	8	8	8	7	8	5	6	10	8	7	8	8	10	8	5	2	7	
459	4VSW	10810.232	5	5	6	4	6	6	4	5	6	6	8	6	6	6	6	6	6	5	3	6	
460	4VSW	4615.296	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	2	3	3	
461	4VSW	3962.836	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	2	2	2	2	
462	4VSW	7266.344	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4	3	4	4	
463	4VSW	1037.068	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	2	2	2	2	
464	4VSW	4453.898	9	7	7	7	7	7	7	4	7	7	7	7	7	7	5	8	7	6	4	5	
465	4VSW	8183.222	12	9	10	10	10	10	10	10	9	10	10	10	10	10	10	10	10	7	8	7	
466	4VSW	776.084	3	2	2	2	2	3	2	2	3	2	2	2	2	2	2	2	2	1	3	2	
470	4X	3159.280	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
471	4X	3447.736	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	
472	4X	4289.066	6	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	3	4	3	
473	4X	910.010	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
474	4X	552.874	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
475	4X	535.704	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
476	4X	5075.452	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4	4	4	4	4	4	
477	4X	4230.688	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
478	4X	800.122	2	2	2	2	2	3	3	2	2	2	2	2	2	2	2	2	3	2	2	2	
480	4X	2249.270	8	8	8	8	8	8	8	8	8	8	7	8	8	8	7	9	8	8	8	8	
481	4X	6438.750	8	9	9	9	9	7	9	9	9	9	8	9	8	9	8	9	6	12	9	7	8
482	4X	3578.228	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	4	3	3	3	
483	4X	1826.888	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
484	4X	7774.576	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	3	4	4	3	4	
485	4X	5432.588	2	3	3	3	3	3	3	3	3	3	3	4	3	5	5	3	2	5	4	5	
490	4X	2063.834	4	4	4	4	4	5	4	4	4	3	4	4	4	4	4	4	3	3	3	4	
491	4X	2359.158	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	4	
492	4X	3729.324	3	3	3	3	3	2	3	3	3	3	3	3	3	3	5	2	3	4	4	4	
493	4X	1830.322	3	3	3	3	3	2	3	3	2	3	3	3	4	5	2	4	4	3	3	4	
494	4X	1431.978	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	3	3	4	
495	4X	2005.456	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	5	3	3	4	
		171809.888	213	189	193	190	195	195	191	193	186	191	213	201	208	216	188	222	209	177	165	196	

Table 6. Number of representative tows conducted in each stratum during the period 2010 to 2020 and for the whole 1970 to 2020 period.

Stratum	NAFO Div.	Area (km2)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
440	4VN	3173.016	4	5	4	4	4	4	4	4	0	5	4	190
441	4VN	3434.000	6	7	6	6	6	6	6	6	0	7	4	238
442	4VN	4934.658	5	6	6	6	6	6	6	6	0	6	5	240
443	4VSW	4526.012	4	6	5	5	3	7	4	5	0	9	4	214
444	4VSW	13478.450	11	13	9	8	9	9	11	10	0	6	8	352
445	4VSW	3512.982	4	7	2	4	3	4	4	4	0	6	3	215
446	4VSW	1686.094	3	4	3	3	3	2	3	2	0	3	2	145
447	4VSW	5549.344	6	8	6	7	7	7	7	7	0	6	5	291
448	4VSW	4975.866	7	10	8	8	8	7	6	6	0	7	4	299
449	4VSW	494.496	2	4	2	2	2	2	2	2	0	2	2	100
450	4VSW	1315.222	3	3	3	3	3	3	3	2	0	3	2	144
451	4VSW	504.798	2	2	2	2	2	2	2	2	0	2	2	104
452	4VSW	1184.730	2	2	2	2	1	4	3	3	0	3	3	110
453	4VSW	889.406	2	1	3	2	3	2	2	1	0	2	2	116
454	4VSW	1713.566	2	4	2	2	2	2	2	2	0	3	2	121
455	4VSW	7286.948	10	10	10	11	11	9	9	8	0	9	6	429
456	4VSW	3279.470	7	9	8	8	6	5	6	6	0	6	4	331
457	4VSW	2784.974	2	4	2	2	2	3	3	3	0	3	2	113
458	4VSW	2259.572	6	9	8	6	4	5	5	5	0	6	3	269
459	4VSW	10810.232	6	7	6	6	6	7	7	6	0	9	7	262
460	4VSW	4615.296	3	4	4	3	3	5	5	5	3	6	5	151
461	4VSW	3962.836	2	3	3	2	2	3	3	3	2	3	3	113
462	4VSW	7266.344	4	6	4	4	5	5	5	5	0	5	5	212
463	4VSW	1037.068	2	3	2	2	2	3	2	2	0	2	2	107
464	4VSW	4453.898	6	7	7	7	7	6	6	4	0	6	4	288
465	4VSW	8183.222	8	10	10	10	10	10	9	7	3	10	7	397
466	4VSW	776.084	2	2	2	2	2	2	2	3	0	3	2	118
470	4X	3159.280	2	2	3	2	2	3	3	3	4	3	2	112
471	4X	3447.736	2	2	3	2	2	3	3	3	4	4	3	110
472	4X	4289.066	4	6	4	4	4	4	4	4	4	4	4	172
473	4X	910.010	2	2	2	2	2	2	2	2	2	2	2	104
474	4X	552.874	2	2	2	2	2	2	2	2	2	2	2	100
475	4X	535.704	2	2	2	2	2	2	2	2	2	2	2	103
476	4X	5075.452	4	4	4	4	4	5	5	5	5	5	5	177
477	4X	4230.688	5	4	5	5	6	5	5	4	4	6	4	204
478	4X	800.122	2	2	2	2	2	2	2	3	2	2	2	119
480	4X	2249.270	8	7	8	8	6	7	7	7	5	7	5	306
481	4X	6438.750	8	10	9	9	9	8	10	9	6	9	6	350
482	4X	3578.228	3	4	3	3	3	3	4	4	3	4	3	141
483	4X	1826.888	2	3	2	2	2	2	3	3	2	3	2	105
484	4X	7774.576	3	5	5	5	4	6	5	7	7	7	7	186
485	4X	5432.588	5	6	5	5	5	6	6	6	4	6	5	196
490	4X	2063.834	3	4	2	4	3	4	4	4	3	4	3	173
491	4X	2359.158	4	4	4	4	4	4	4	4	3	4	3	168
492	4X	3729.324	4	6	4	4	4	3	4	4	3	4	4	171
493	4X	1830.322	3	4	4	4	3	3	4	6	3	3	3	159
494	4X	1431.978	4	4	4	4	3	4	4	3	2	4	3	128
495	4X	2005.456	3	4	4	4	2	4	4	4	3	4	3	127
		171809.888	196	243	210	208	196	212	214	208	81	227	175	9080

424 **3.2 Distribution of depth, bottom temperature and bottom salinity from survey tows**

425 The depth, bottom temperature and bottom salinity cumulative frequency distribution for the  
426 survey are presented in Figure 5.

427 **3.2.1 Decadal distribution of surface and bottom temperatures**

428 The decadal cumulative frequency distribution of surface and bottom temperatures are presented  
429 in Figure 6.

430 **4 Discussion**

431 This report builds on previous work and former atlases by updating a comprehensive suite of  
432 indices to give a snapshot of population status and environmental preferences of 104 fish and  
433 invertebrate species. The current document is not meant to replace stock assessments, species-  
434 specific analyses of abundance, biomass and distribution, or any targeted attempts to integrate  
435 information about species or group of species from the wide and disparate sources of data about  
436 marine organisms in the area covered by the DFO Maritimes summer trawl survey. It is rather  
437 meant to provide a reproducible set of tools to extract and visualize the information collected  
438 in the summer groundfish research vessel survey. It is hoped that this document can provide a  
439 stepping stone to conduct other ecological analyses using the trawl survey data and increase  
440 reproducibility and transparency of ecological information collected annually.

441 **4.1 Diversity of approaches used for mapping fish and invertebrates in the Scotian Shelf  
442 bioregion**

443 Different methods have been applied in the Northwest Atlantic, and specifically on the Scotian  
444 Shelf bioregion, to map fish and invertebrate species distribution. The present report, for  
445 example, builds upon the atlas of important habitat developed to map the persistence of relatively  
446 high biomass for key fish species using the summer groundfish research vessel survey (Horsman  
447 and Shackell 2009). Important habitat was obtained by interpolating observed weight per each  
448 species using an inverse-distance weighted (IDW) methodology, and calculating areas with  
449 relatively persistent high biomass for periods representing different fishery management eras.  
450 To compliment information from this atlas, including additional representations of biomass and  
451 diversity, a similar IDW interpolation mapping procedure was followed by Smith et al. (2015),  
452 Ward-Paige and Bundy (2015), and Bundy et al. (2017). The summer groundfish research vessel  
453 survey is typically conducted during the month of July. However, from the fall of 1978 through to  
454 the spring of 1985, DFO also conducted spring and fall surveys using the same sampling design.  
455 This unique seasonal data was used to map the seasonal spatial distribution of key demersal  
456 and other fish species using IDW interpolation on the Scotian Shelf from the spring, summer  
457 and fall between 1978 and 1985 (Smith et al. 2015). Following recommendations provided by  
458 Kenchington and Kenchington (2017), the spatial distribution of three indicators of biodiversity

459 for fish and invertebrates were mapped using IDW interpolation to identify areas with persistently  
460 high values across fishery management eras, and compared with areas of persistently high  
461 abundance for selected species (Ward-Paige and Bundy 2015). This analysis revealed a lack of  
462 consistent relationships between areas of persistent high diversity and persistent high biomass,  
463 suggesting that both can be used as independent and important spatial indicators of the system  
464 (Ward-Paige and Bundy 2015). Groupings of fishes and invertebrates based on size, habitat  
465 and feeding guild, were also mapped using IDW interpolations to identify hotspots of functional  
466 group diversity (Bundy et al. 2017). This analysis revealed a spatially and temporally variable  
467 distribution of functional diversity across the Scotian Shelf with notable areas of high and low  
468 diversity (Bundy et al. 2017). Top quintiles of each functional group using the IDW approach  
469 were used as representative layers for fish and invertebrates in the MPA Network design in the  
470 Scotian Shelf Bioregion (Serdynska et al. In press). IDW interpolation methods have also been  
471 used to map the distribution of individual species such as sea cucumbers (*Cucumaria frondosa*)  
472 in the Scotian Shelf bioregion (Shackell et al. 2013), and sea scallop (*Placopecten magellanicus*)  
473 in Georges and Browns Bank (Hubley et al. 2014).

474 Species Distribution Modelling (SDM), instead of IDW, can also be used to evaluate spatio-  
475 temporal dynamics by predicting and understanding past, present and future distribution  
476 of species using environmental predictors (Robinson et al. 2017). A variety of modelling  
477 approaches are being implemented in Maritimes Region to map and predict fish and invertebrate  
478 species distribution by incorporating environmental predictors to account for seasonal and  
479 temporal variability. For example, a stock assessment of snow crab (*Chionoecetes opilio*) on  
480 the Scotian Shelf used data from the snow crab survey from 2005 to 2018 to map spatial data  
481 products for this stock, including annual predicted interpolations of potential habitat using  
482 Generalized Additive Models (GAM) and several environmental covariates including depth,  
483 curvature, slope, species composition, and annual temperature (Zisserson et al. 2019). Sea  
484 scallop predicted habitat using Maximum Entropy (MaxEnt) models were computed for German  
485 Bank using data compiled via benthic habitat mapping and seafloor geotechnical surveys in  
486 2006, 2009, and 2010 (Brown et al. 2012). Predictions in the Scotian Shelf bioregion and the  
487 Northeast United States using datasets from DFO and the National Oceanic and Atmospheric  
488 Administration from 1993 to 2012 also predicted sea scallop habitat at a wider scale based  
489 on three scenarios of seasonal temperature and salinity climatologies (NOAA) (Lowen et  
490 al. 2019). Offshore American lobster stock assessments (*Homarus americanus*) used data  
491 from the RV, DFO Georges Bank, and National Marine Fisheries Service (NMFS) Northeast  
492 Fisheries Science Center (NEFSC) bottom trawl surveys (1970 to 2015) to predict species  
493 distribution using boosted regression trees and several environmental predictors (bathymetry,  
494 slope, curvature, and annual temperature interpolations) (Cook et al. 2017). Information on  
495 the potential for recovery of cusk (*Brosme brosme*) used data from the bottom longline Halibut  
496 industry survey and Cusk absences in the Summer groundfish research vessel survey from  
497 1998-2013 to predict suitable habitat using GAM, MaxEnt, and random forest models and  
498 several physical environmental variables (e.g. complexity, benthic current stress and complexity,  
499 temperature, salinity, primary production, chlorophyll, suspended matter) (Harris et al. 2018).  
500 Atlantic halibut (*Hippoglossus hippoglossus*) assessments using Summer groundfish research  
501 vessel survey and NOAA survey data from 2001 to 2013 predicted juvenile habitat using MaxEnt  
502 model and environmental predictors (bathymetry, slope, bottom temperature) (French et al.  
503 2018). Persistent areas of high Atlantic halibut juvenile abundance were predicted using data  
504 from 27 bottom trawl surveys combined (NMFS and DFO) from 1978 to 2013 and applying  
505 Bayesian hierarchical spatiotemporal models with two environmental predictors (depth and

506 temperature) (Boudreau et al. 2017).

507 These examples of mapping efforts in Maritimes Region showcase the diversity of approaches  
508 relevant to a variety of important research questions and management applications. Approaches,  
509 methods, datasets, and environmental predictors are selected based on individual project  
510 research questions, and considerations for each species, communities or stock. This allows  
511 research groups to maintain innovation and keep up with emerging methods and technologies to  
512 improve assessments, predictions, and ultimately, science advice. The diversity of approaches  
513 also leads to complexity when looking across studies as each data compilation and predictive  
514 method carries its own independent assumptions and can lead to different spatial outputs.

## 515 **4.2 Interpreting spatial results for marine spatial planning purposes**

516 Fisheries and Oceans Canada is leading a marine spatial planning process that brings together  
517 relevant authorities and stakeholders to better coordinate how we use and manage marine  
518 spaces to achieve ecological, economic and social objectives. Operationalizing marine spatial  
519 planning includes a series of steps, including the process of analyzing existing conditions  
520 by collecting and mapping information about ecological, environmental and oceanographic  
521 conditions (Ehler and Douvere 2009; Agardy et al. 2011). Mapping the distribution of species  
522 is critical for the implementation of spatial management and as a first step in marine spatial  
523 planning processes. Species distribution have supported the identification of important sites for  
524 a given species or areas of high richness and diversity, which in turn can be used to inform siting  
525 decisions of new activities such as Marine Protected Areas (MPA), aquaculture sites or wind  
526 turbines. In the Scotian Shelf bioregion, mapping species distributions has been used to highlight  
527 areas of high biological diversity to support the identification of Ecologically or Biologically  
528 Significant Areas (Ricard and Shackell 2013; Ward-Paige and Bundy 2015), to distinguish  
529 important and persistent habitat of significant species and functional groups to support MPA and  
530 conservation planning (Horsman and Shackell 2009; Smith et al. 2015; Ward-Paige and Bundy  
531 2015; Bundy et al. 2017), to identify important habitat for Species at Risk (Harris et al. 2018) and  
532 to highlight reserves for data-poor invertebrate fisheries (Shackell et al. 2013). Mapping species  
533 distribution has also been used to illustrate multi-decadal scale projections of changes in species  
534 distribution in the context of climate change and adaption (Stanley et al. 2018; Greenan et al.  
535 2019).

536 In support of the marine spatial planning process, a public web-based atlas with relevant  
537 geospatial information is being developed to support decision-making. This Atlantic Canada-  
538 wide compilation of data and information will be a web-based, public platform with interactive  
539 maps of ocean ecosystems, human uses and management areas. The current document cannot  
540 present the full diversity of data and mapping products that can be produced for the Maritimes  
541 Region. Consequently, we recommend that the data and mapping products presented in this  
542 report not be used blindly for the planned atlas, until an evaluation of what spatial information is  
543 available and what was used in the past is conducted.

544 This diverse portfolio of approaches and applications is not unique to the Maritimes Region. A  
545 recent review of global distribution modelling efforts recommended the adoption of a consistent  
546 framework that integrates multi-model approaches and a clear expression of errors and  
547 uncertainties (Robinson et al. 2017). In this context, Pacific Region has developed two initiatives

548 to enable consistency and frequent publication, reproducibility, and transparency. One initiative  
549 developed a reproducible report to give a synthesis of data availability, population trends, fishing  
550 trends, growth and maturity patterns for 113 groundfish species in British Columbia to support  
551 stock assessment (Anderson et al. 2019). The second initiative developed a SDM framework  
552 that was applied to twelve species on Canada's Pacific coast as part of the Regional Response  
553 Plan (Nephin et al. 2019). The Maritimes and Gulf region, through this and past reports, are also  
554 using similar reproducible approaches to facilitate annual updates and transparency (Ricard and  
555 Shackell 2013; Ricard et al. 2021).

556 Recognizing the diversity of approaches for mapping fish and invertebrates in the Scotian Shelf  
557 bioregion, we recommend the development of a regional community of practice to compare  
558 and evaluate approaches for mapping, interpolating and/or modelling fish and invertebrates  
559 so future publications and advice related to spatial outputs can lead to more comparable work  
560 and consistent science advice to support processes such as marine spatial planning. At the  
561 international level, guidelines and standards related to appropriate variables and methods  
562 for mapping and modeling species and communities of deep-sea habitats were proposed to  
563 encourage the production of publications that will lead to more comparable work (Kenchington  
564 et al. 2019). Similar general guidance for how groups approach mapping activities would be a  
565 worthwhile product in Maritimes Region. Until then, we propose the use of the Open Data record  
566 for the Maritimes RV surveys (DFO 2021) as a precursor to the public web-based marine spatial  
567 planning atlas.

568

## 5 Acknowledgements

569 We thank all the dedicated personnel involved in running trawl surveys in the Maritimes Region  
570 and the numerous colleagues in Maritimes Region that have shared information and advice in  
571 support of this report. The assistance of the Gulf Region secondary publications coordinators,  
572 Alicia Cassidy and Jeff Clements, in getting this report published is well appreciated. This  
573 document greatly benefited from the constructive comments of two reviewers.

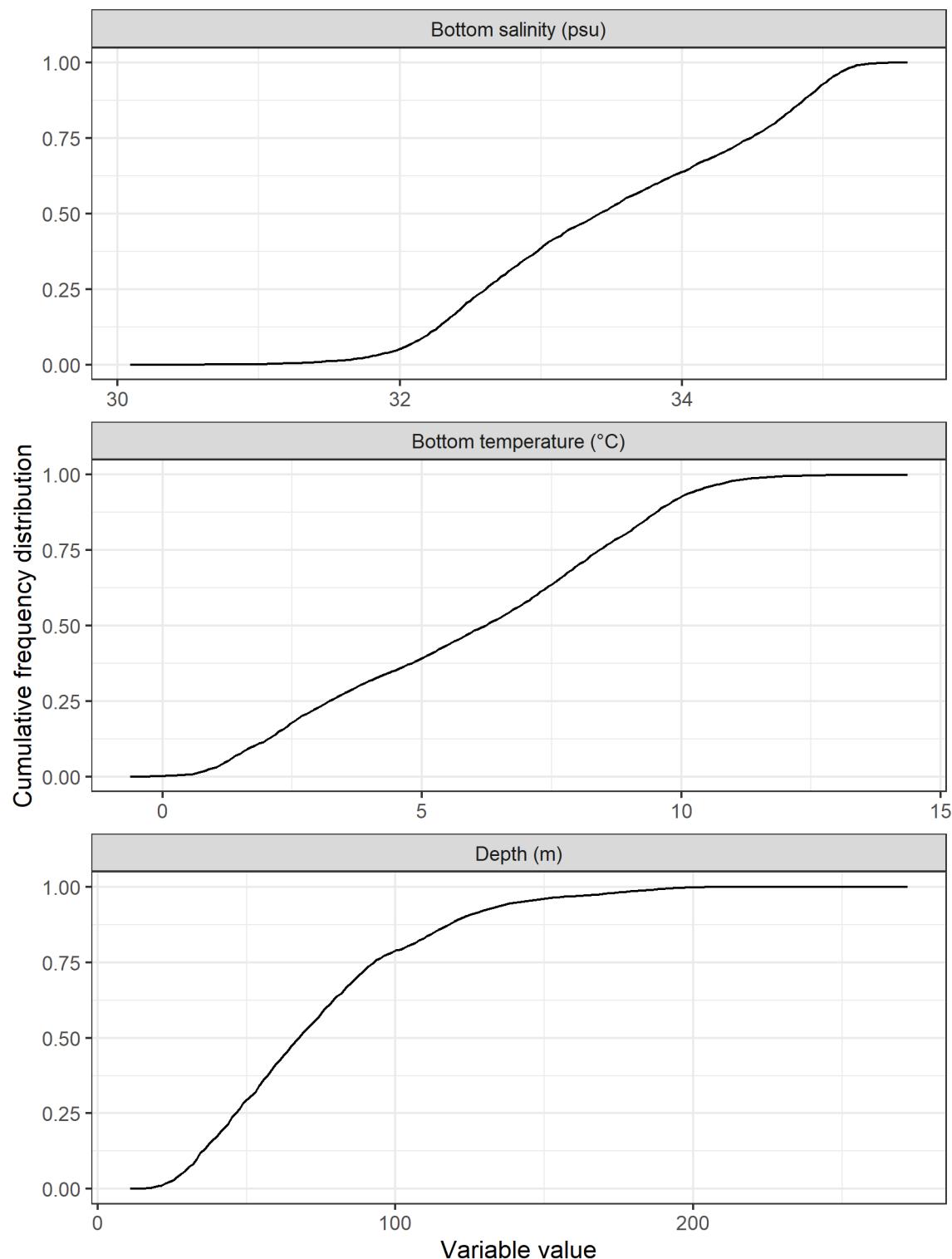


Figure 5. Cumulative frequency distribution of bottom salinity (top panel), bottom temperature (middle panel) and depth (bottom panel) of representative sets from the DFO Maritimes summer survey.

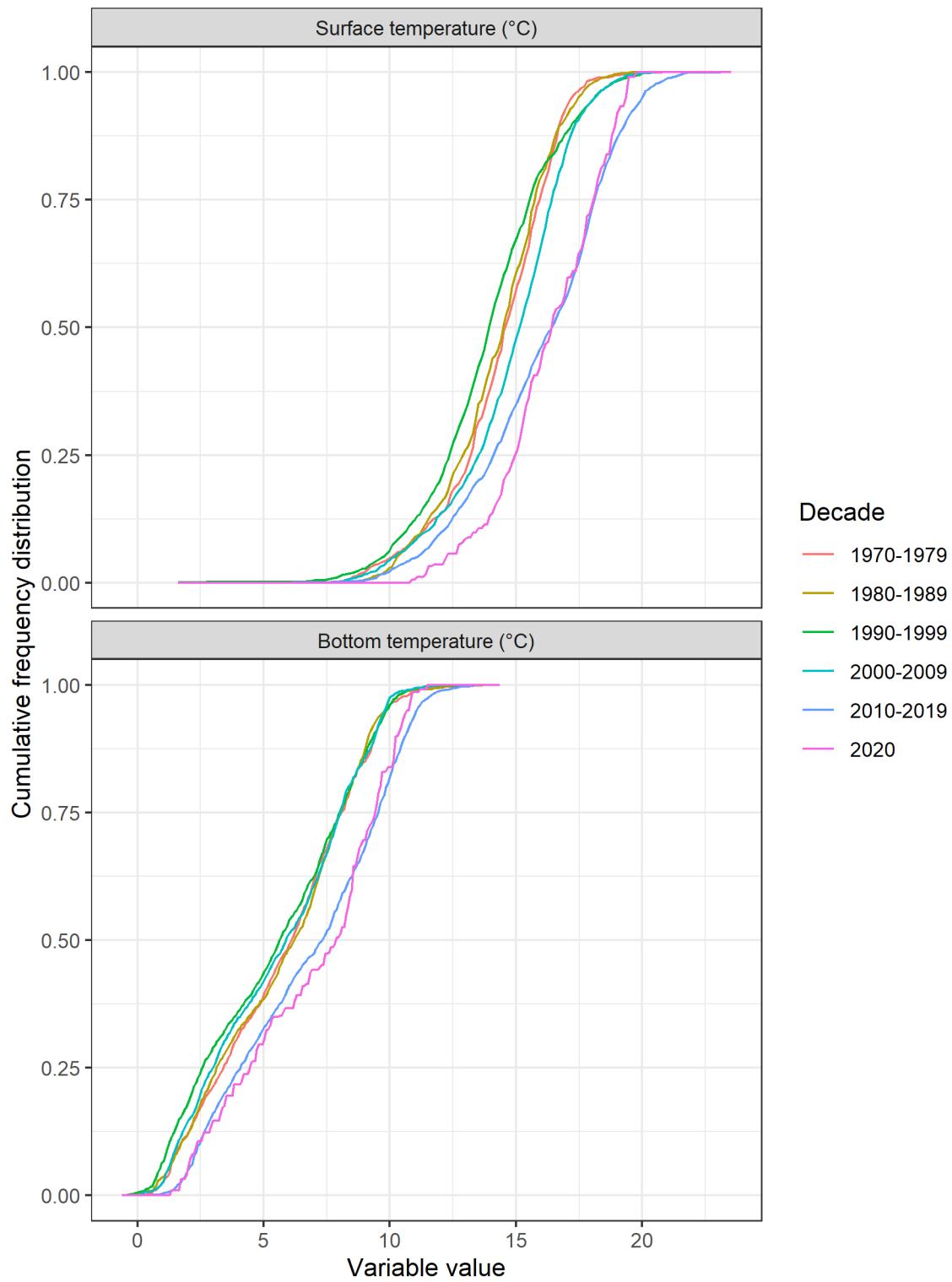


Figure 6. Decadal cumulative frequency distribution of surface temperature (top panel) and bottom temperature (bottom panel) of representative sets from the DFO Maritimes summer survey.

## 6 References

- 576 Agardy, T., Notarbartolo di Sciara, G., and Christie, P. 2011. [Addressing the shortcomings of](#)  
 577 [marine protected areas through large scale marine spatial planning](#). Marine Policy 35(2):  
 578 226–232.
- 579 Anderson, S.C., Grandin, C., Edwards, A.M., Grinnell, M.H., Ricard, D., and Haigh, R. 2021.  
 580 Csasdown: Reproducible CSAS Reports with Bookdown.
- 581 Anderson, S.C., Keppel, E.A., and Edwards, A.M. 2019. [A reproducible data synopsis for](#)  
 582 [over 100 species of British Columbia groundfish](#). DFO Can. Sci. Advis. Sec. Res. Doc.  
 583 2019/041. vii + 321 p.
- 584 Appeltans, W., Bouchet, P., Boxshall, G.A., De Broyer, C., Voogd, N.J. de, Gordon, D.P.,  
 585 Hoeksema, B.W., Horton, T., Kennedy, M., J., M., Poore, G.C.B., Read, G., Stöhr,  
 586 S., Walter, T.C., and Costello, M.J. (*Editors*). 2012. World register of marine species.  
 587 Accessed at <http://www.marinespecies.org> on 2020-12-1.
- 588 Baddeley, R., A. 2015. Spatial point patterns: Methodology and applications  
 589 with R. Chapman; Hall/CRC Press, London [http://www.crcpress.com/  
 590 Spatial-Point-Patterns-Methodology-and-Applications-with-R/  
 591 Baddeley-Rubak-Turner/9781482210200/](http://www.crcpress.com/Spatial-Point-Patterns-Methodology-and-Applications-with-R-Baddeley-Rubak-Turner/9781482210200/).
- 592 Benoît, H.P., Abgrall, M.-J., and Swain, D.P. 2003. [An assessment of the general status of](#)  
 593 [marine and diadromous fish species in the southern Gulf of St. Lawrence based on annual](#)  
 594 [bottom trawl surveys \(1971-2002\)](#). Can. Tech. Rep. Fish. Aquat. Sci. 2472: iv + 183 p.
- 595 Bivand, R. 2020. classInt: Choose univariate class intervals. R package version 0.4-3 <https://CRAN.R-project.org/package=classInt>.
- 596 Bivand, R., and Lewin-Koh, N. 2020. Maptools: Tools for handling spatial objects. R package  
 597 version 1.0-2 <https://CRAN.R-project.org/package=maptools>.
- 598 Bivand, R., and Rundel, C. 2020. Rgeos: Interface to geometry engine - open source  
 ('GEOS'). R package version 0.5-5 <http://CRAN.R-project.org/package=rgeos>.
- 601 Boudreau, S.A., Shackell, N.L., Carson, S., and Heyer C. E., den. 2017. [Connectivity,](#)  
 602 [persistence, and loss of high abundance areas of a recovering marine fish population in](#)  
 603 [the Northwest Atlantic Ocean](#). Ecol. Evol. 7: 9739–9749.
- 604 Bourdages, H., and Ouellet, J.-F. 2012. [Geographic distribution and abundance indices of](#)  
 605 [marine fish in the northern Gulf of St. Lawrence \(1990-2009\)](#). Can. Tech. Rep. Fish.  
 606 Aquat. Sci. 2963: vi + 171 p.
- 607 Brown, C., Sameoto, J., and Smith, S. 2012. [Multiple methods, maps, and management](#)  
 608 [applications: Purpose made seafloor maps in support of ocean management](#). Journal of  
 609 Sea research 72: 113.
- 610 Bundy, A., Will, E., Serdynska, A., Cook, A., and Ward-Paige, C.A. 2017. [Defining and](#)  
 611 [mapping functional groups for fishes and invertebrates in the Scotian Shelf bioregion](#). Can.  
 612 Tech. Rep. Fish. Aquat. Sci. 3186: iv + 49 p.

- 613 Clark, D.W., and Emberley, J. 2011. Update of the 2010 summer scotian shelf and bay of  
614 fundy research vessel survey. Can. Tech. Rep. Fish. Aquat. Sci.: 1238: ix + 98 p.
- 615 Cook, A.M., Cassista Da-Ros, M., and Denton, C. 2017. [Framework Assessment of the](#)  
616 [Offshore American Lobster in Lobster Fishing Area \(LFA\) 41.](#) ICES Journal of Marine  
617 Science 2017/065 viii + 186 p.
- 618 DFO. 2016. DFO maritimes research vessel trawl surveys invertebrate observations. Version  
619 7 in OBIS canada digital collections. Bedford Institute of Oceanography, Dartmouth, NS,  
620 Canada, Published by OBIS, Digital 2016.
- 621 DFO. 2021. Maritimes research vessel surveys [dataset]. Retrieved from  
622 <https://open.canada.ca/data/en/dataset/8ddcaeeaa-b806-4958-a79f-ba9ab645f53b>.
- 623 Doubleday, W.G., and Rivard, D. 1981. Bottom trawl surveys. Can. Spec. Publ. Fish. Aquat.  
624 Sci: 58: 237 pp.
- 625 Ehler, C., and Douvere, F. 2009. Marine spatial planning: A step-by-step approach.
- 626 French, K., Shackell, N., and Heyer, N. den. 2018. [Information on the Potential for Recovery](#)  
627 [of Cusk in Canadian Waters.](#) Fish. Bull. 116: 107–121.
- 628 Greenan, B.J.W., Shackell, N.L., Ferguson, K., Greyson, P., Cogswell, A., Brickman, D.,  
629 Wang, Z., Cook, A., Brennan, C.E., and Saba, V.S. 2019. Climate change vulnerability  
630 of American lobster fishing communities in Atlantic Canada. Frontiers in Marine Science 6:  
631 579.
- 632 Harris, L.E., Greenlaw, M., McCurdy, D., and MacDonald, D. 2018. [Information on the](#)  
633 [Potential for Recovery of Cusk in Canadian Waters.](#) DFO Can. Sci. Advis. Sec. Res. Doc.  
634 2018/002. vi + 62 p.
- 635 Holstein, J. 2018. Worms: Retrieving aphia information from world register of marine species.  
636 R package version 0.2.2 <https://CRAN.R-project.org/package=worms>.
- 637 Horsman, T.L., and Shackell, N.L. 2009. [Atlas of important habitat for key fish species of the](#)  
638 [Scotian Shelf, Canada.](#) Can. Tech. Rep. Fish. Aquat. Sci. 2835: viii + 82 p.
- 639 Hubley, P.B., Reeves, A., Smith, S.J., and Nasmyth, L. 2014. [Georges Bank 'a' and Browns](#)  
640 [Bank 'North' Scallop \(\*Placopecten magellanicus\*\) Stock Assessment.](#) DFO Can. Sci.  
641 Adv. Sec. Res. Doc. 2013/079. vi + 58 p.
- 642 Kenchington, E., Callery, O., Davidson, F., Grehan, A., Morato, T., Appiott, J., Davis, A.,  
643 Dunstan, P., Du Preez, C., Finney, J., González-Irusta, J.M., Howell, K., Knudby, A.,  
644 Lacharité, M., Lee, J., Murillo, F.J., Beazley, L., Roberts, J.M., Roberts, M., Rooper, C.,  
645 Rowden, A., Rubidge, E., Stanley, R., Stirling, D., Tanaka, K.R., Vanhatalo, J., Weigel, B.,  
646 Woolley, S., and Yesson, C. 2019. [Use of Species Distribution Modeling in the Deep Sea.](#)  
647 Can. Tech. Rep. Fish. Aquat. Sci. 3296: ix + 76 p.
- 648 Kenchington, T.J., and Kenchington, E.L.R. 2017. [Biodiversity metrics for use in the](#)  
649 [ecosystem approach to oceans management.](#) Can. Tech. Rep. Fish. Aquat. Sci. 3186:  
650 iv + 49 p.

- 651 Lohr, S. 1999. Sampling: Design and analysis. Pacific Grove, CA: Brooks/Cole Publishing  
652 Company.
- 653 Losier, R.J., and Waite, L.E. 1989. Systematic listing of scientific and/or common names of  
654 invertebrates and marine plants and their respective codes used by marine fish division,  
655 Fisheries and Oceans, Scotia-Fundy Region. Canadian Data Report of Fisheries and  
656 Aquatic Sciences (721).
- 657 Lowen, B., Hart, D., Stanley, R., Lehnert, S., Bradbury, I., and C., D. 2019. [Assessing effects](#)  
658 [of genetic, environmental, and biotic gradients in species distribution modelling](#). ICES  
659 Journal of Marine Science 76(6): 1762–1775.
- 660 Myers, R.A., and Stokes, K. 1989. Density-dependent habitat utilization of groundfish and the  
661 improvement of research surveys. (D:15). International Council for the Exploration of the  
662 Sea Council Meeting.
- 663 Nephin, J., Gregr, E.J., St. Germain, C., Fields, C., and Finney, J.L. and. 2019. [Development](#)  
664 [of a Species Distribution Modelling Framework and its Application to Twelve Species on](#)  
665 [Canada's Pacific Coast](#). DFO Can. Sci. Advis. Sec. Res. Doc. 2020/004. xii + 107 p.
- 666 Neuwirth, E. 2014. RColorBrewer:ColorBrewer palettes. R package version 1.1-2 <https://CRAN.R-project.org/package=RColorBrewer>.
- 667
- 668 Pebesma, E. 2004. Multivariable geostatistics in S: The gstat package. *In* Computers and  
669 Geosciences.
- 670 Perry, R.I., and Smith, S.J. 1994. Identifying habitat associations of marine fishes using  
671 survey data: An application to the northwest atlantic. Canadian Journal of Fisheries and  
672 Aquatic Sciences (51(3)): 589–602.
- 673 R Core Team. 2020. R: A language and environment for statistical computing. R Foundation  
674 for Statistical Computing, Vienna, Austria.
- 675 Ricard, D., and Gomez, C. 2021. Maritimes-SUMMER-atlas. <https://github.com/dfo-gulf-science/Maritimes-SUMMER-Atlas>; GitHub.
- 676
- 677 Ricard, D., Rolland, N., and Swain, D. 2021. Occurrence, geographic distribution and  
678 abundance indices of marine organisms caught in the september research vessel trawl  
679 survey in the southern Gulf of St. Lawrence (1971-2020). Can. Tech. Rep. Fish. Aquat.  
680 Sci. xxxx: viii + 180 p.
- 681 Ricard, D., and Shackell, N.L. 2013. [Population status \(abundance/biomass, geographic](#)  
682 [extent, body size and condition\), important habitat, depth, temperature and salinity of](#)  
683 [marine fish and invertebrates on the Scotian Shelf and Bay of Fundy \(1970-2012\)](#). Can.  
684 Tech. Rep. Fish. Aquat. Sci. 3012: viii + 180 p.
- 685 Ripley, B., and Lapsley, M. 2019. RODBC: ODBC database access. R package version 1.3-16  
686 <http://CRAN.R-project.org/package=RODBC>.
- 687 Ripley, B., Venables, B., Bates, D., Hornik, K., Gebhardt, A., and Firth, D. 2020. Modern  
688 applied statistics with s. R package version 7.3-53 <https://cran.r-project.org/web/packages/MASS/index.html>.
- 689

- 690 Robinson, N.M., Nelson, W.A., Costello, M.J., Sutherland, J.E., and Lundquist, C.J.  
691 2017. Systematic review of marine-based species distribution models (SDMs) with  
692 recommendations for best practice. *Front. Mar. Sci.* (4): 421.
- 693 Schnute, J.T., Boers, N., and Haigh, R. 2019. PBSmapping: Mapping fisheries data and  
694 spatial analysis tools. R package version 2.72.1 <https://cran.r-project.org/web/packages/PBSmapping/index.html>.
- 695
- 696 Shackell, N., Brickman, D., and Frank, K. 2013. [Reserve site selection for data-poor  
697 invertebrate fisheries using patch scale and dispersal dynamics: A case study of sea  
698 cucumber](#). *Aquatic Conserv: Mar. Freshw. Ecosyst.* 23: 723–731.
- 699 Simon, J.E., and Comeau, P.A. 1994. [Summer distribution and abundance trends of species  
700 caught on the Scotian Shelf from 1970-92, by the research vessel groundfish survey](#). *Can.  
701 Tech. Rep. Fish. Aquat. Sci.* 1953.
- 702 Smith, C.D., Serdynska, A.R., King, M.C., and Shackell, N.L. 2015. [Spring, summer and  
703 fall distribution of common demersal fishes on the Scotian Shelf between 1978 and 1985](#).  
704 *Can. Tech. Rep. Fish. Aquat. Sci.* 3068: vi + 38 p.
- 705 Smith, S.J. 1996. Assessment of groundfish stocks based on bottom trawl survey results.  
706 NAFO Scientific Council Studies 28: 25–53.
- 707 Stanley, R.E., DiBacco, C., Lowen, B., Beiko, R., Jeffery, N., Wyngaarden, M., Bentzen, P.,  
708 Brickman, D., Benestan, L., Bernatchez, L., Johnson, C., Snelgrove, P., Wang, Z., and  
709 Wringe, I., B. Bradbury. 2018. A climate-associated multispecies cryptic cline in the  
710 northwest Atlantic. *Science Advances* 4(3): 1–7.
- 711 Swain, D.P., and Morin, R. 1996. Relationships between geographic distribution and  
712 abundance of American plaice (*Hippoglossoides platessoides*) in the southern Gulf of  
713 St. Lawrence. *Canadian Journal of Fisheries and Aquatic Sciences* 53(1): 106–119.
- 714 Swain, D.P., and Sinclair, A.F. 1994. Fish distribution and catchability: What is the appropriate  
715 measure of distribution? *Canadian Journal of Fisheries and Aquatic Sciences* 51(5):  
716 1046–1054.
- 717 Tremblay M. J., B.R., Black G. A. P. 2007. The distribution of common decapod crustaceans  
718 and other invertebrates recorded in annual ecosystem surveys of the scotian shelf 1999-  
719 2006, by the research vessel groundfish survey. *Can. Tech. Rep. Fish. Aquat. Sci.* 74.
- 720 Ward-Paige, C.A., and Bundy, A. 2015. [Mapping Biodiversity on the Scotian Shelf and in the  
721 Bay of Fundy](#). *Can. Tech. Rep. Fish. Aquat. Sci.* 3068: vi + 38 p.
- 722 Wickham, H. 2019. Tidyverse: Easily install and load the 'tidyverse'. R package version 1.3.0  
723 <https://cran.r-project.org/web/packages/tidyverse/index.html>.
- 724 Zisserson, B.M., Cameron, B.J., Glass, A.C., and Choi, J.S. 2019. [Assessment of Scotian  
725 Shelf Snow Crab in 2017](#). DFO Can. Sci. Advis. Sec. Res. Doc. 2018/051. ix + 147 p.

## 7 Appendix

727

## 7.1 Atlantic cod (*Morue franche*) - species code 10 (category LF)

728

Scientific name: [Gadus morhua](#)

729

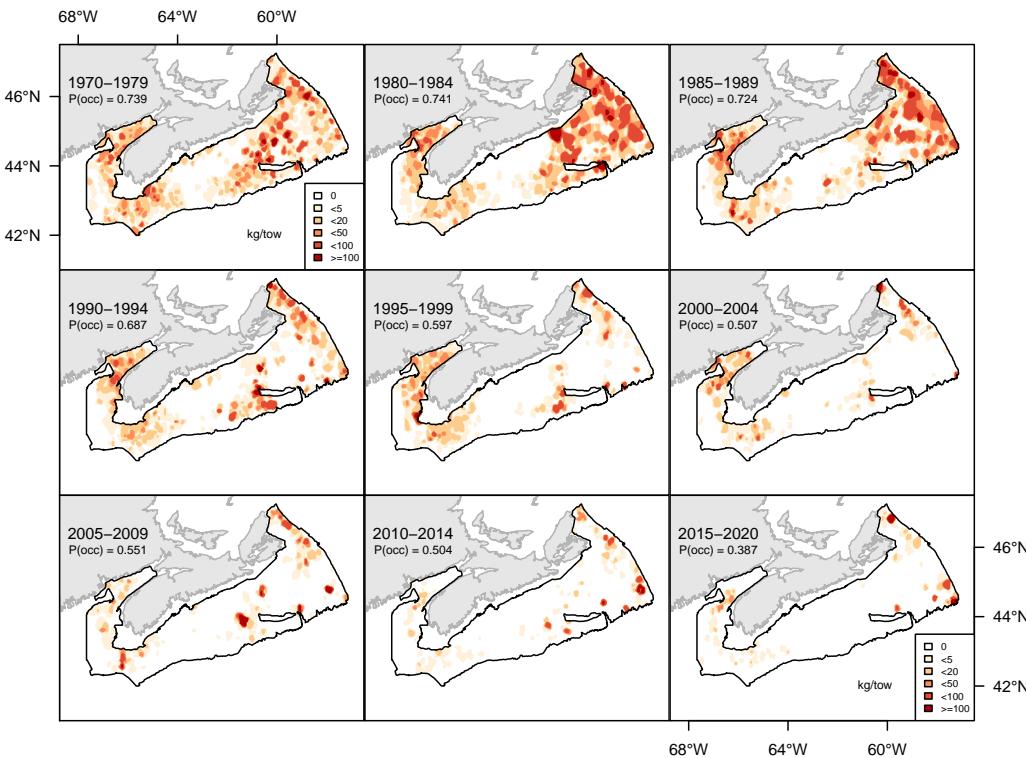


Figure 7.1A. Inverse distance weighted distribution of catch biomass (kg/tow) for Atlantic cod.

730

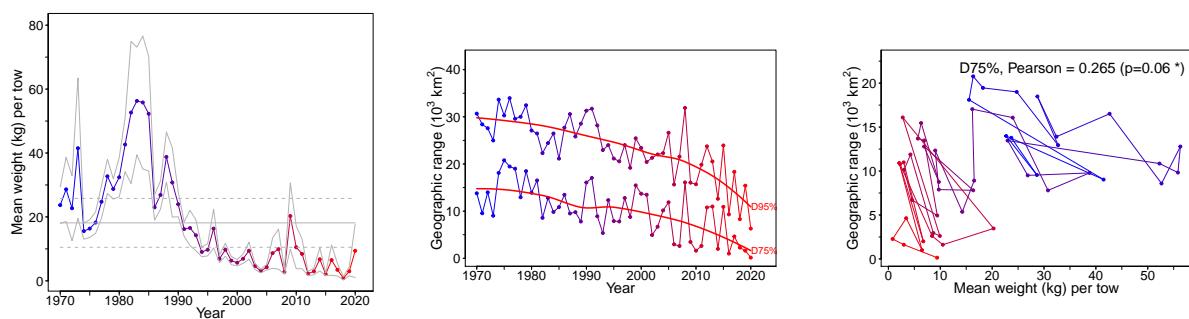


Figure 7.1B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Atlantic cod.

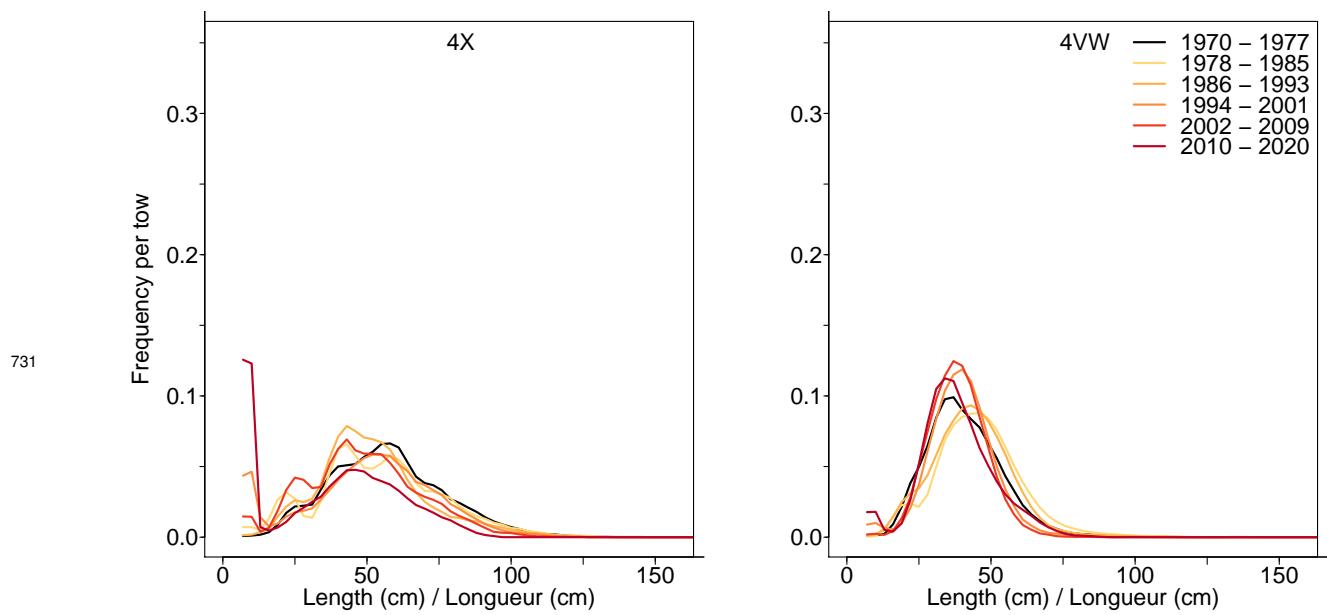


Figure 7.1C. Length frequency distribution in NAFO units 4X and 4VW for Atlantic cod.

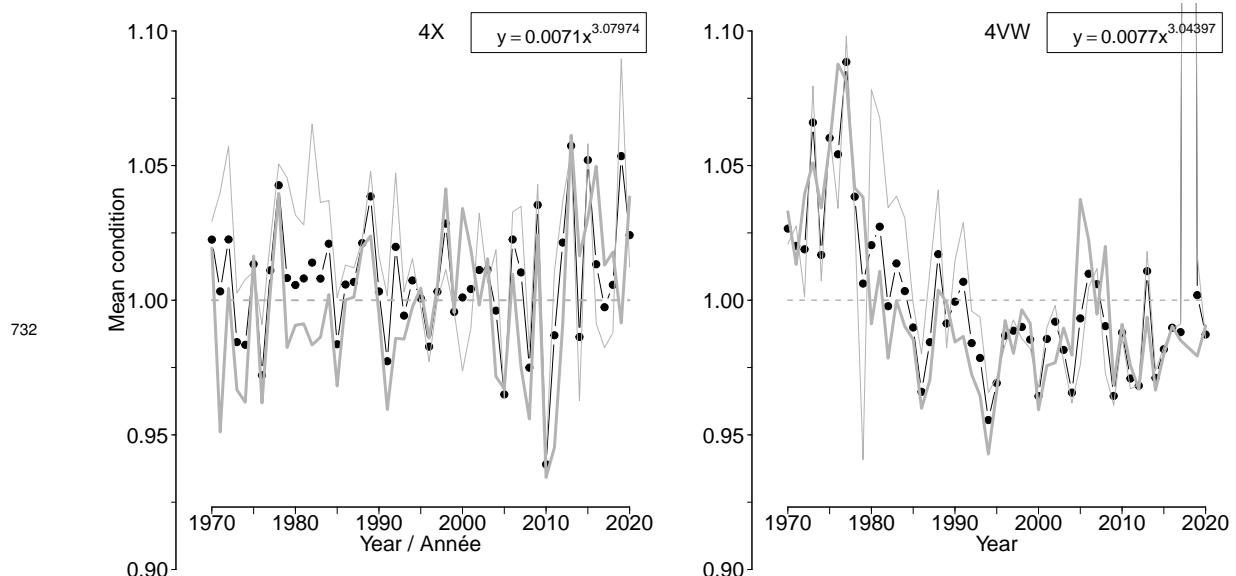
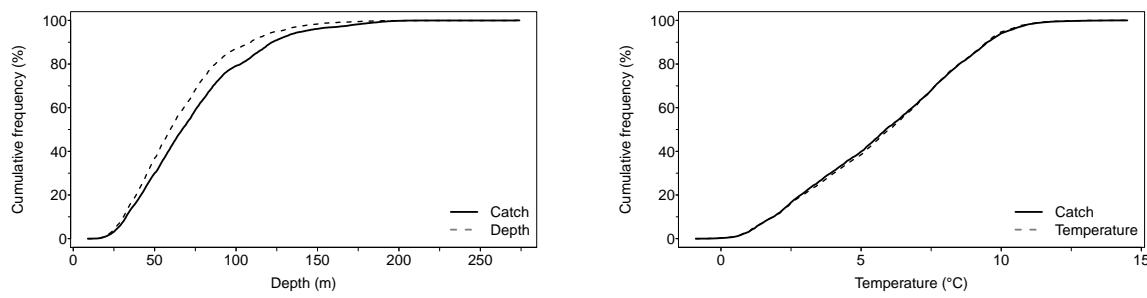
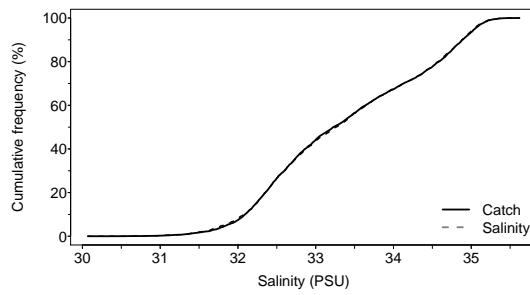


Figure 7.1D. Average fish condition in NAFO units 4X and 4VW for Atlantic cod.



733



Freq	Depth	Temp	Sal
F5	26	1.2	31.00
F25	43	3.5	32.47
F50	60	6.0	33.27
F75	82	8.1	34.40
F95	126	10.0	35.03

Figure 7.1E. Catch distribution by depth, temperature and salinity of Atlantic cod.

734

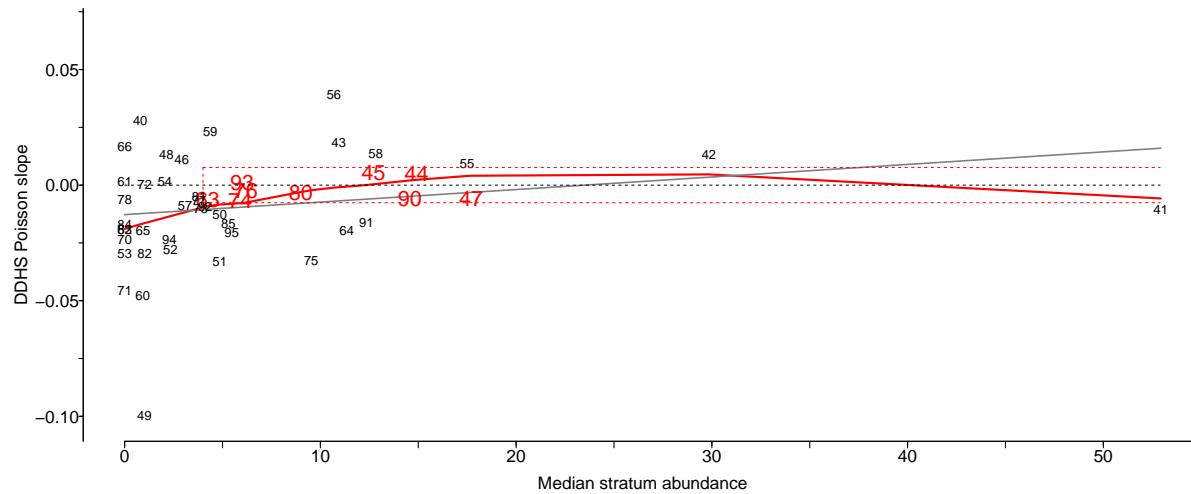


Figure 7.1F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Atlantic cod.

735

## 7.2 Haddock (Aiglefin) - species code 11 (category LF)

736

Scientific name: [Melanogrammus aeglefinus](#)

737

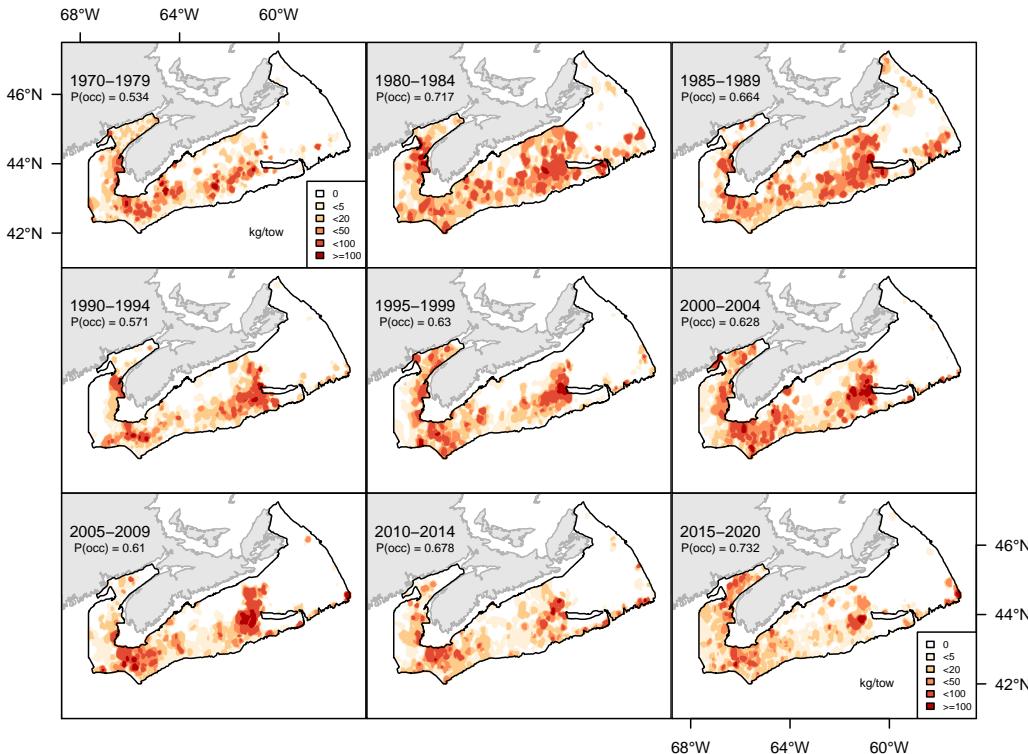


Figure 7.2A. Inverse distance weighted distribution of catch biomass (kg/tow) for Haddock.

738

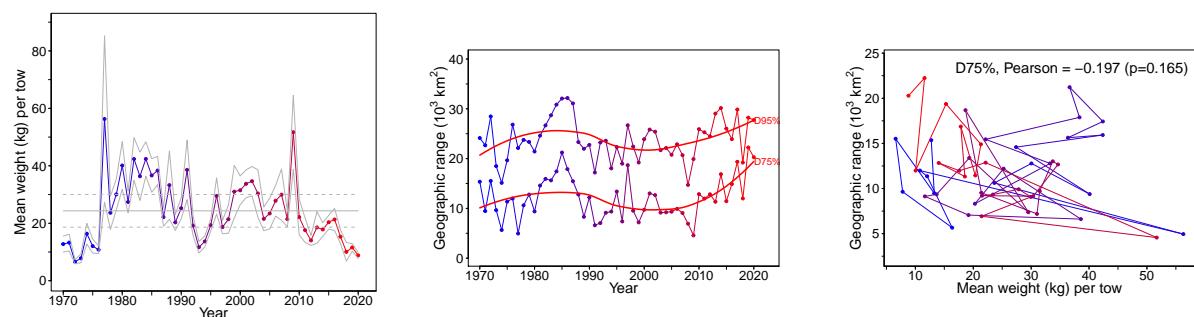


Figure 7.2B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Haddock.

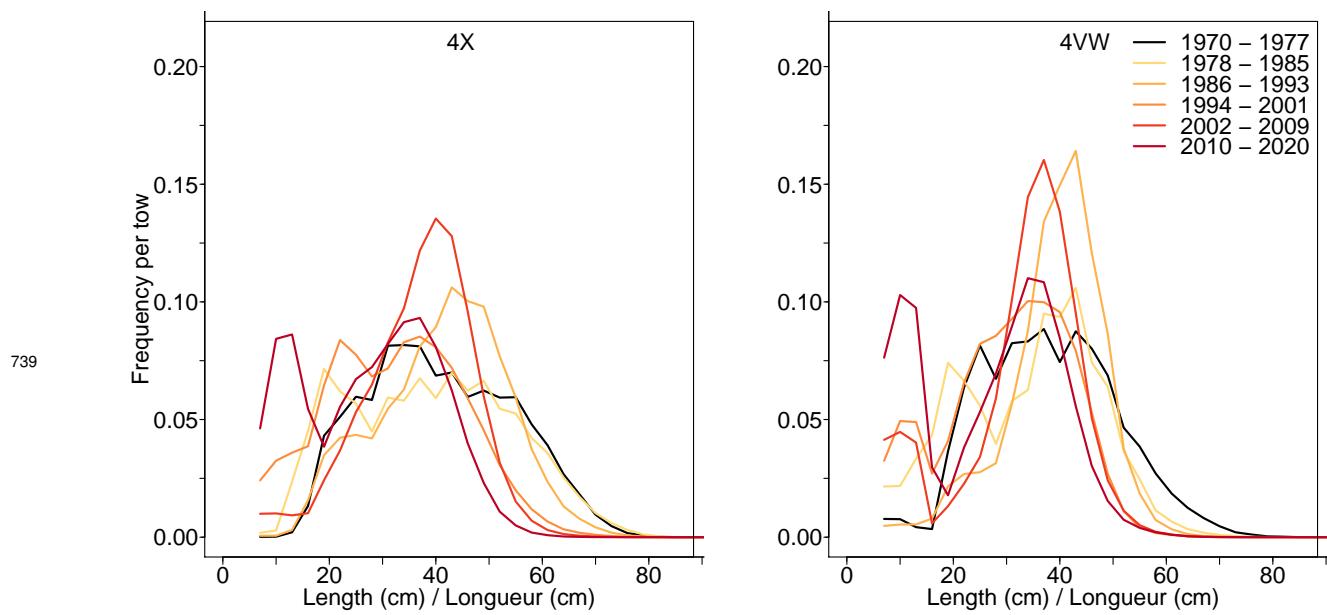


Figure 7.2C. Length frequency distribution in NAFO units 4X and 4VW for Haddock.

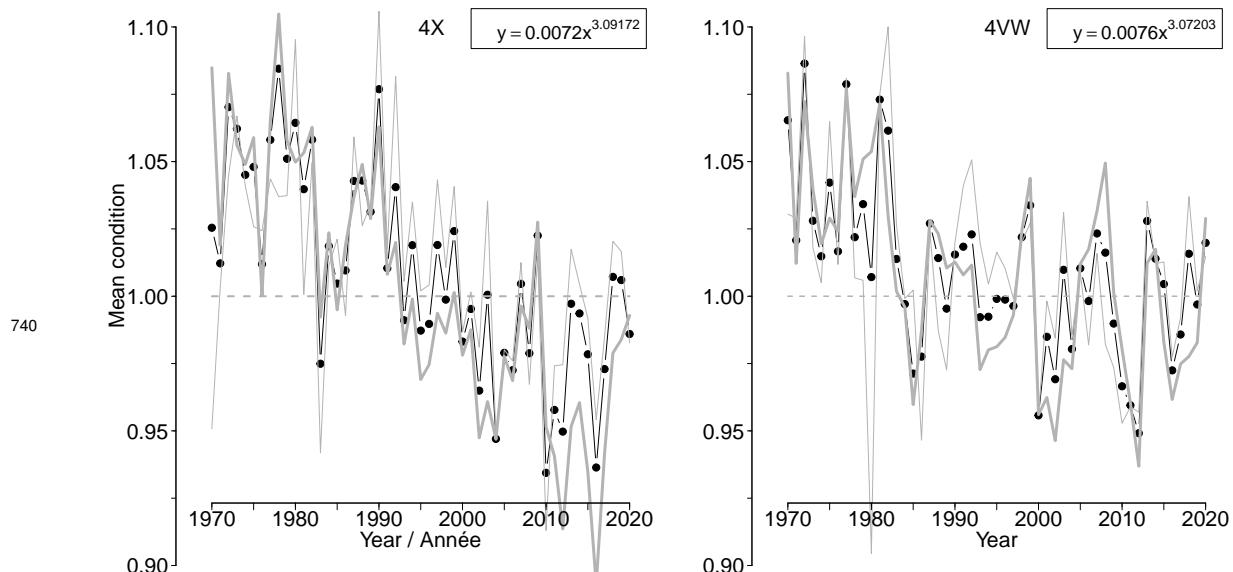
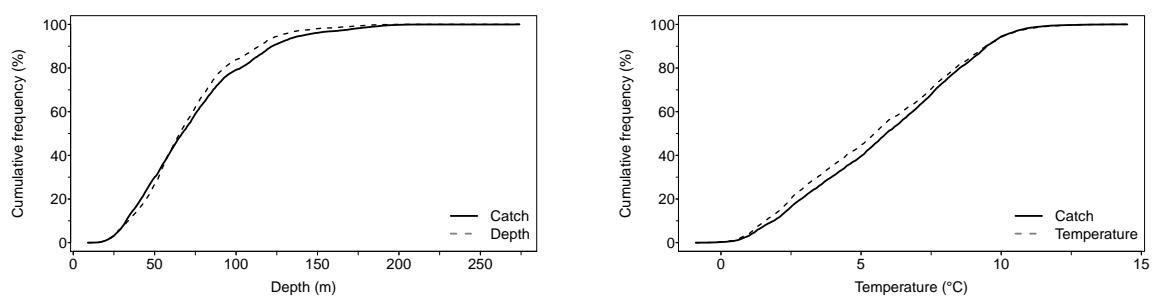
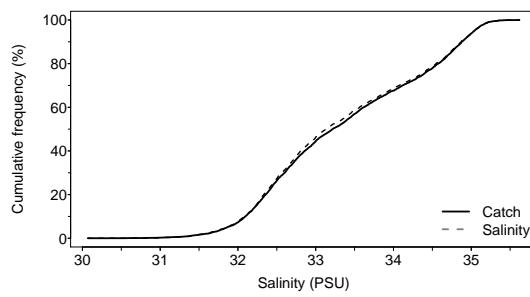


Figure 7.2D. Average fish condition in NAFO units 4X and 4VW for Haddock.



741



Freq	Depth	Temp	Sal
F5	27	1.1	31.00
F25	49	3.0	32.45
F50	66	5.5	33.14
F75	87	7.9	34.36
F95	127	10.0	35.03

Figure 7.2E. Catch distribution by depth, temperature and salinity of Haddock.

742

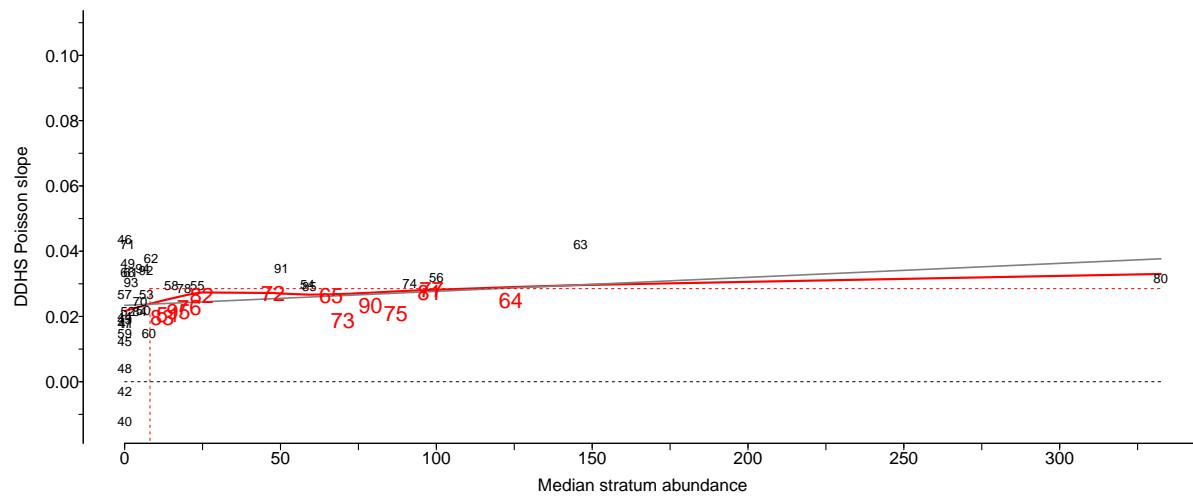


Figure 7.2F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Haddock.

743

### 7.3 White hake (Merluche blanche) - species code 12 (category LF)

744

Scientific name: [Urophycis tenuis](#)

745

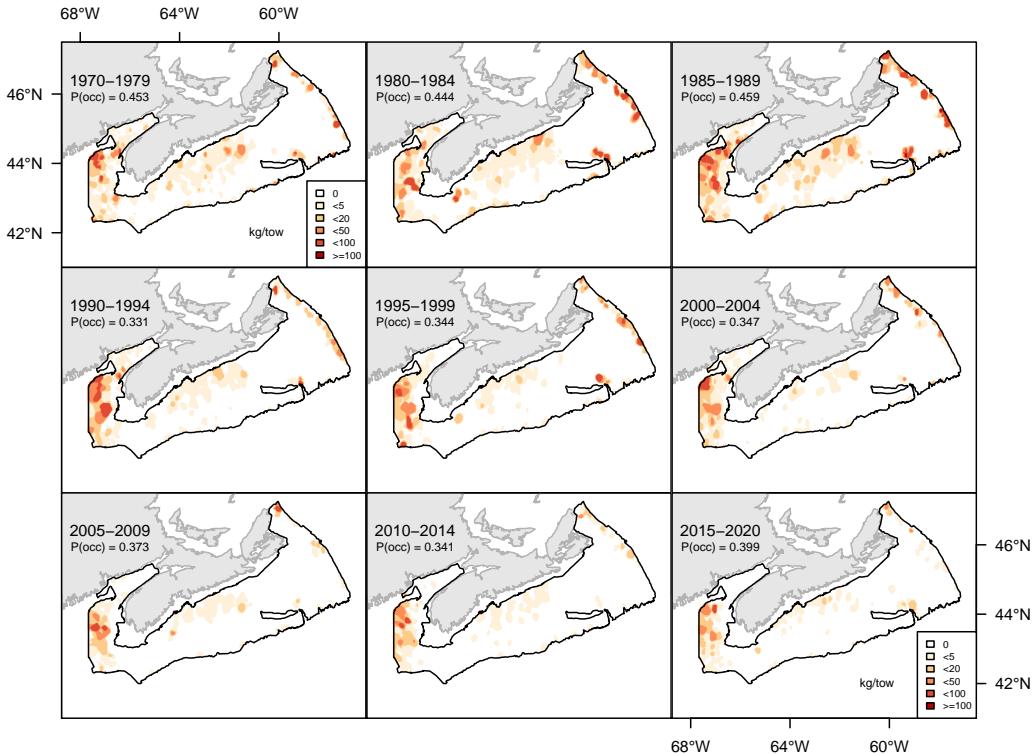


Figure 7.3A. Inverse distance weighted distribution of catch biomass (kg/tow) for White hake.

746

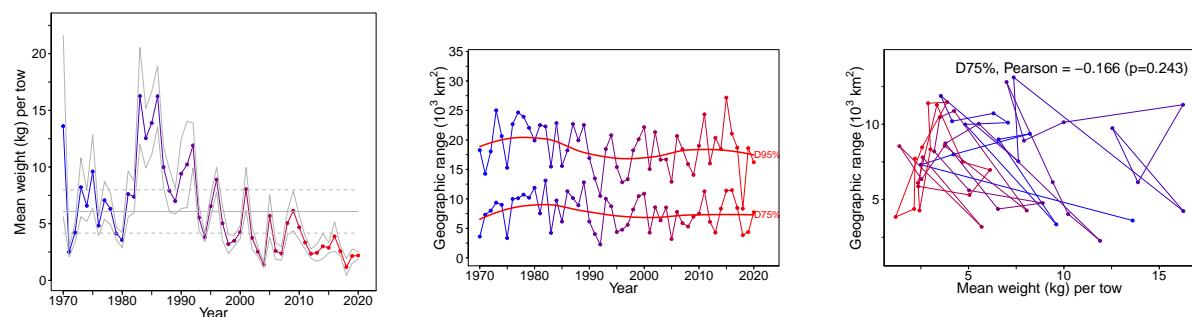


Figure 7.3B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of White hake.

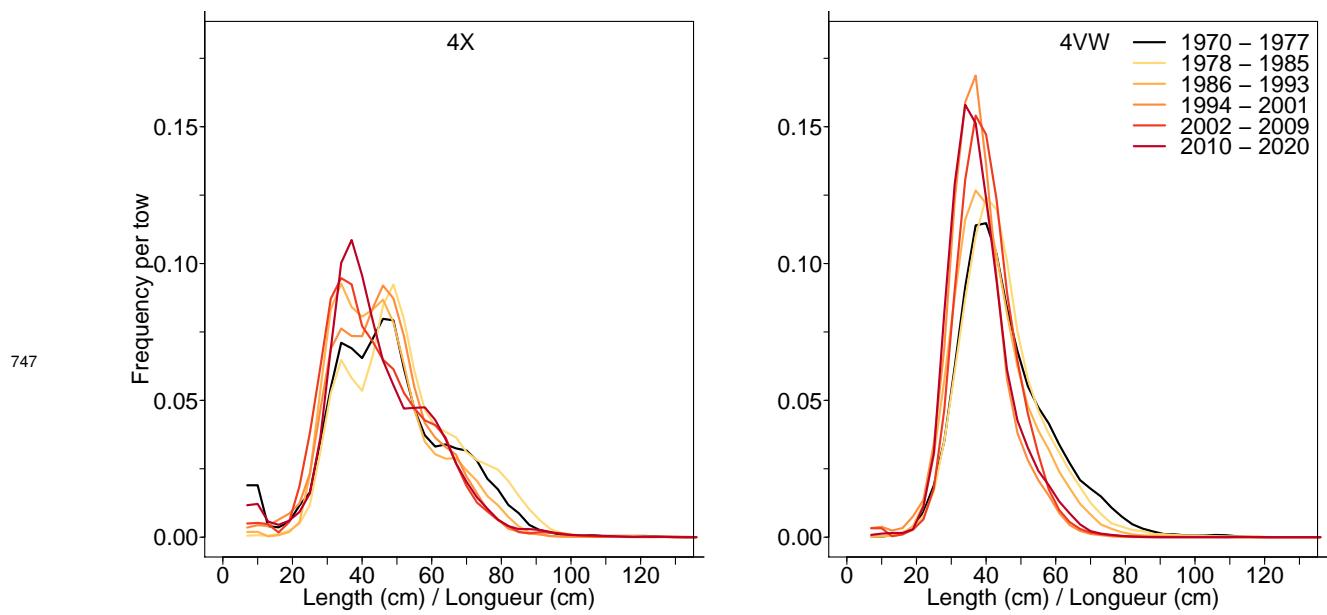


Figure 7.3C. Length frequency distribution in NAFO units 4X and 4VW for White hake.

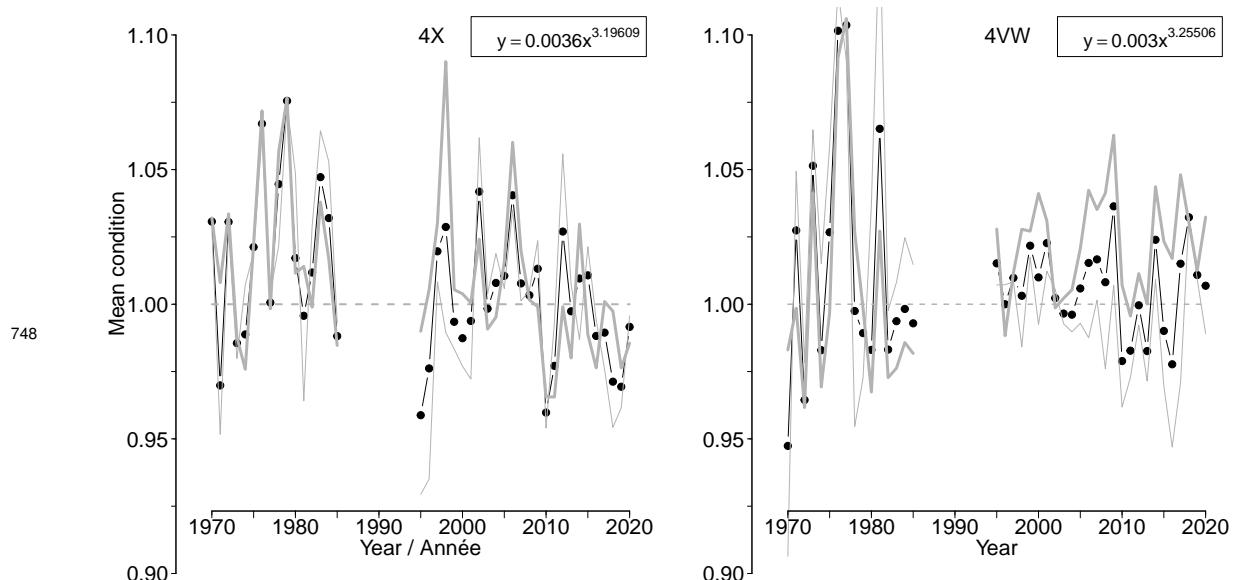
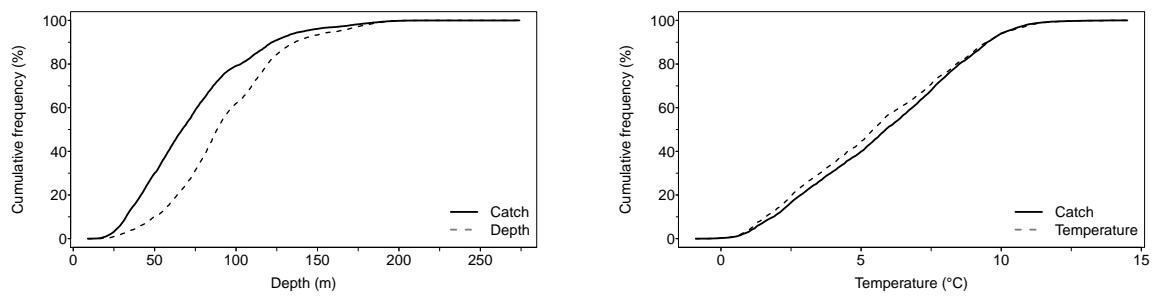
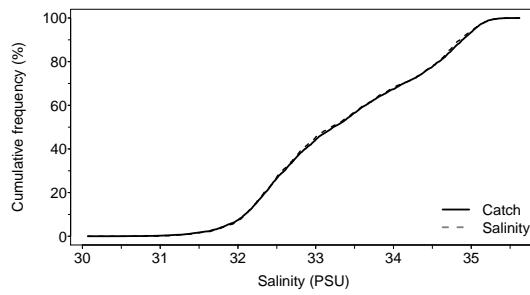


Figure 7.3D. Average fish condition in NAFO units 4X and 4VW for White hake.



749



Freq	Depth	Temp	Sal
F5	40	1.1	31.00
F25	70	3.0	32.46
F50	89	5.5	33.20
F75	115	7.9	34.39
F95	163	10.0	35.04

Figure 7.3E. Catch distribution by depth, temperature and salinity of White hake.

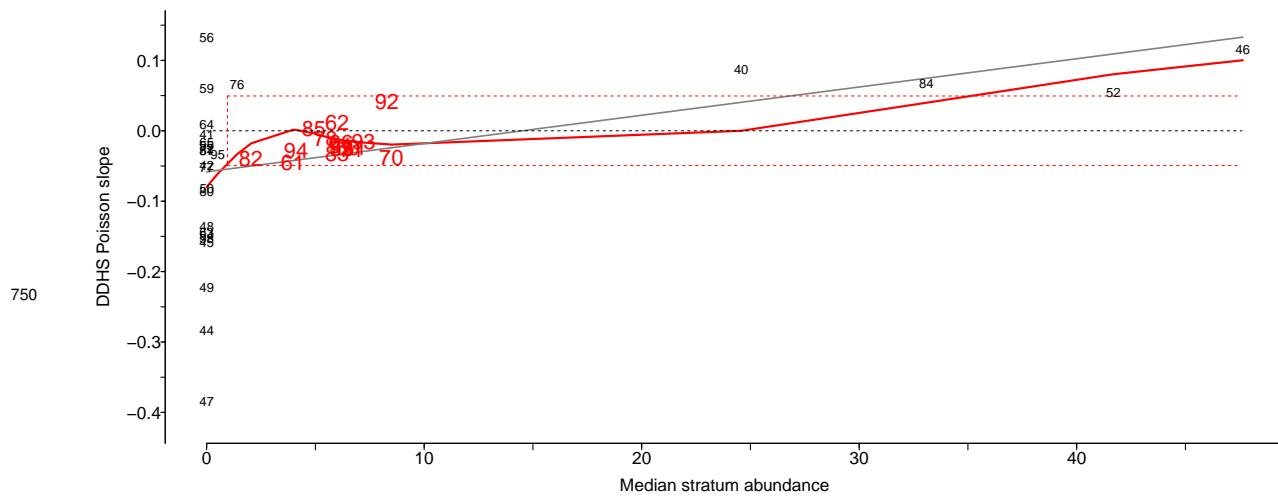


Figure 7.3F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for White hake.

751

## 7.4 Red hake (Merluche écureuil) - species code 13 (category LF)

752

Scientific name: [Urophycis chuss](#)

753

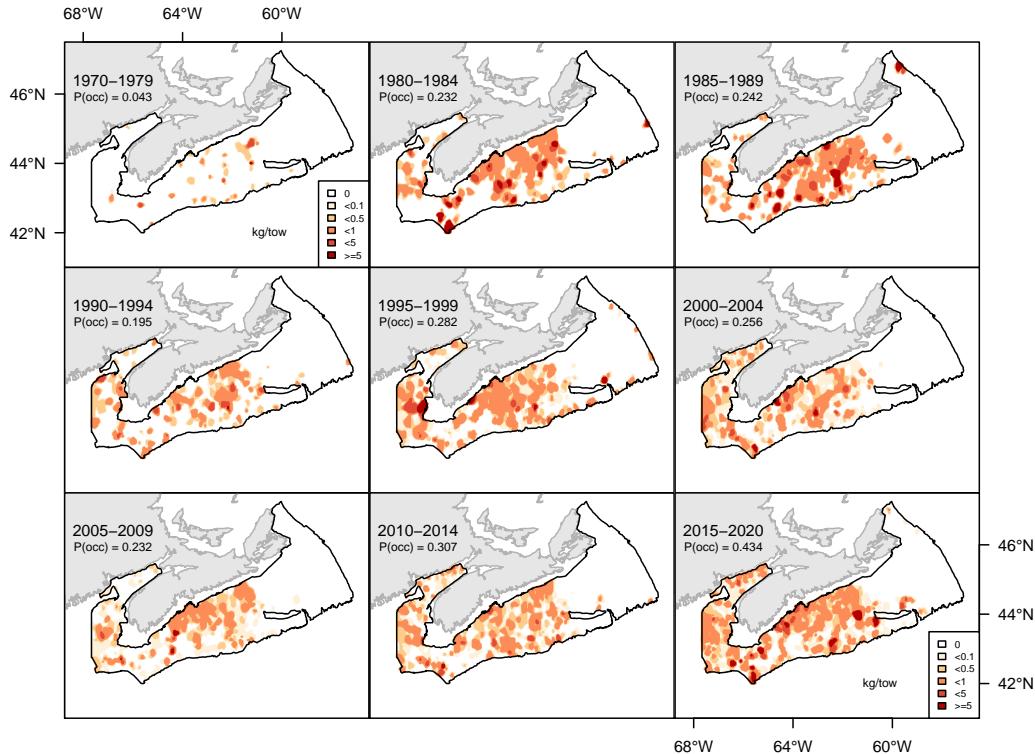


Figure 7.4A. Inverse distance weighted distribution of catch biomass (kg/tow) for Red hake.

754

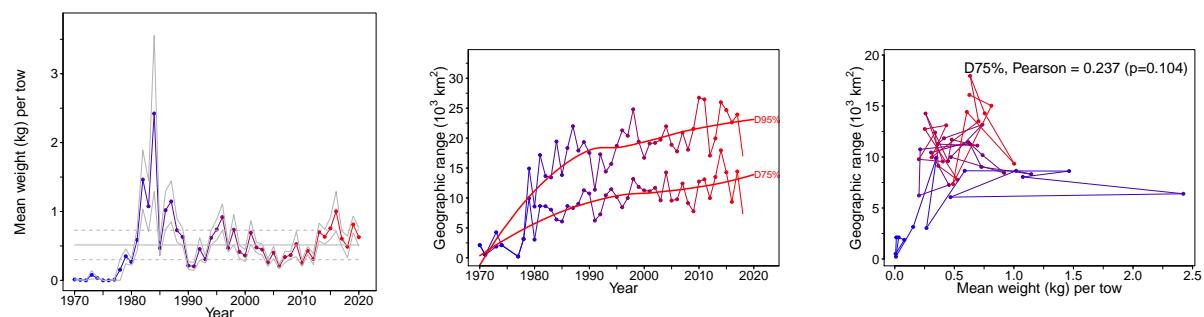


Figure 7.4B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Red hake.

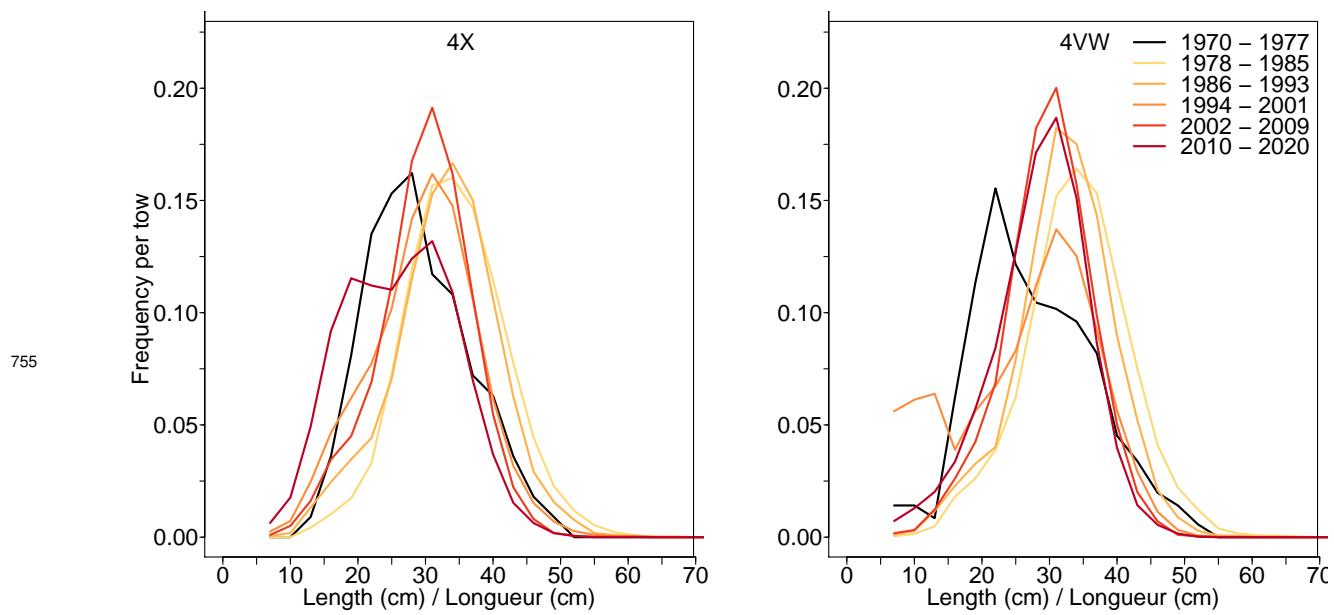


Figure 7.4C. Length frequency distribution in NAFO units 4X and 4VW for Red hake.

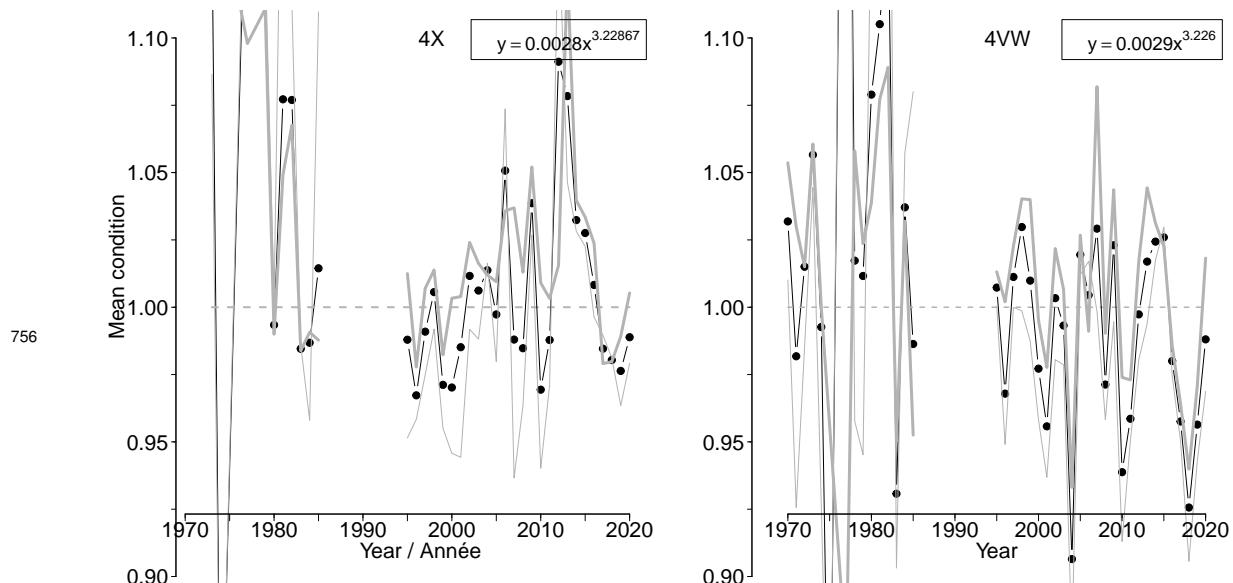
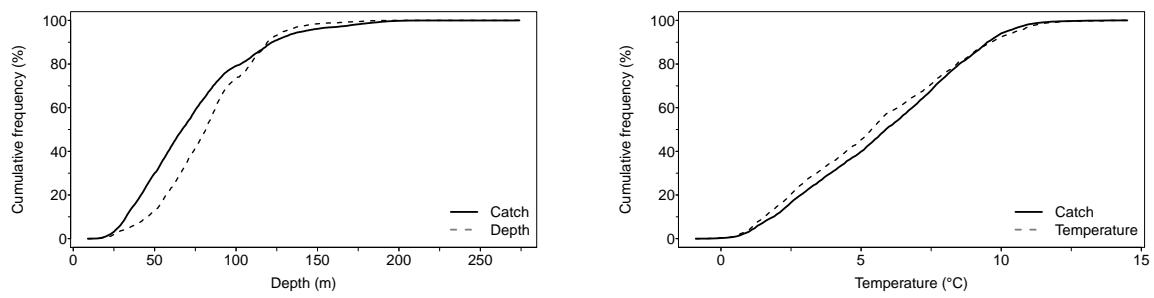
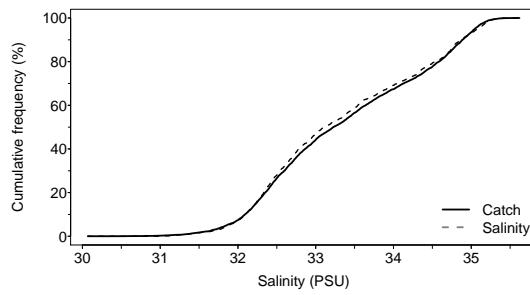


Figure 7.4D. Average fish condition in NAFO units 4X and 4VW for Red hake.



757



Freq	Depth	Temp	Sal
F5	35	1.1	31.00
F25	62	2.9	32.43
F50	82	5.4	33.12
F75	103	7.9	34.32
F95	130	10.0	35.08

Figure 7.4E. Catch distribution by depth, temperature and salinity of Red hake.

758

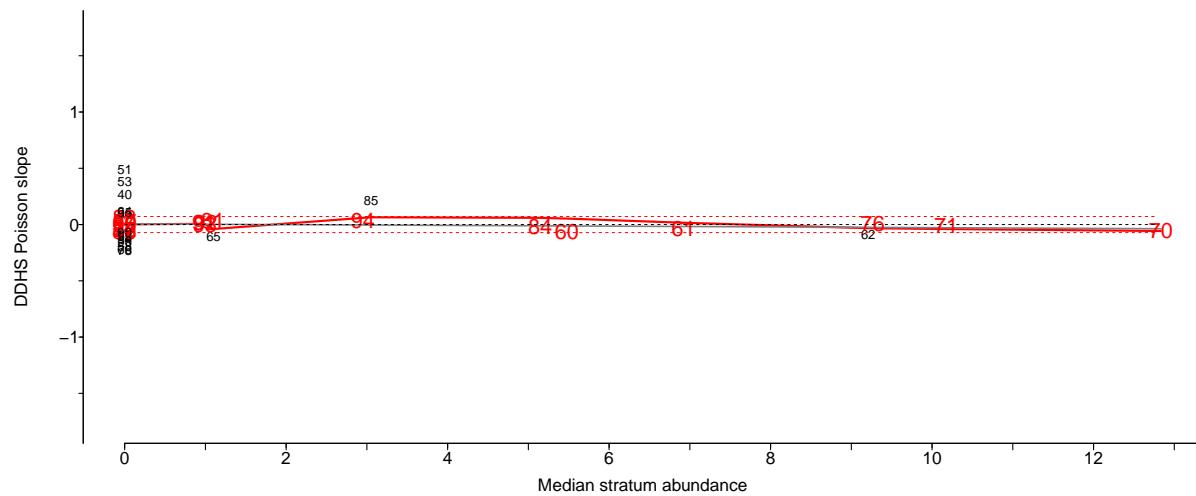


Figure 7.4F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Red hake.

759

## 7.5 Silver hake (*Merlu argenté*) - species code 14 (category LF)

760

Scientific name: [Merluccius bilinearis](#)

761

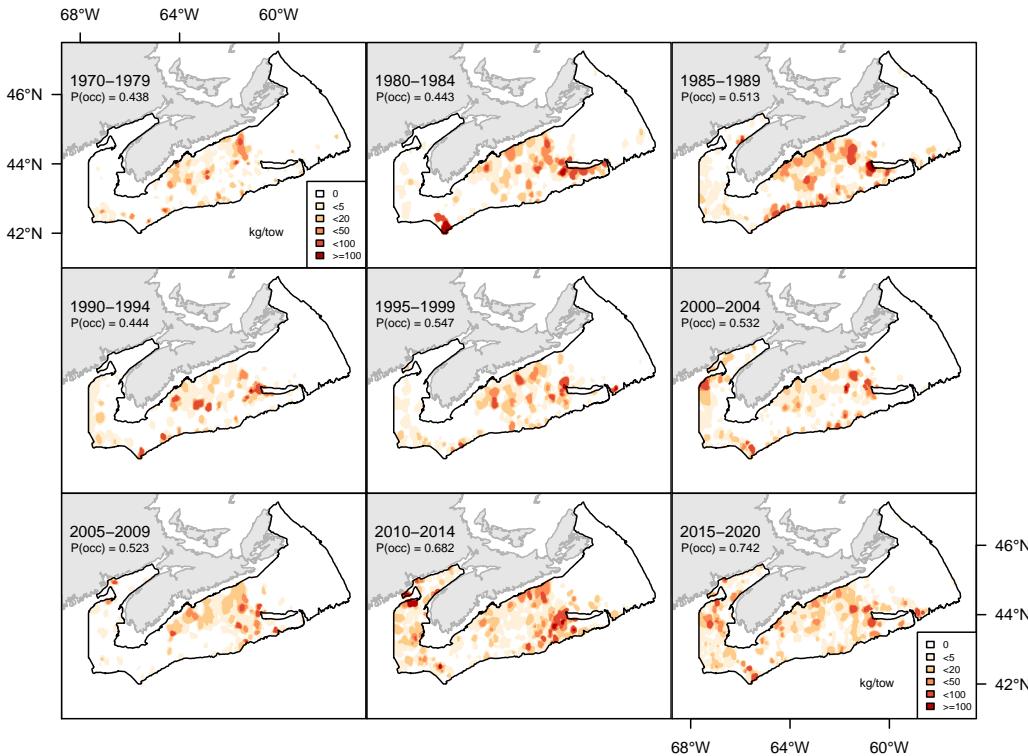


Figure 7.5A. Inverse distance weighted distribution of catch biomass (kg/tow) for Silver hake.

762

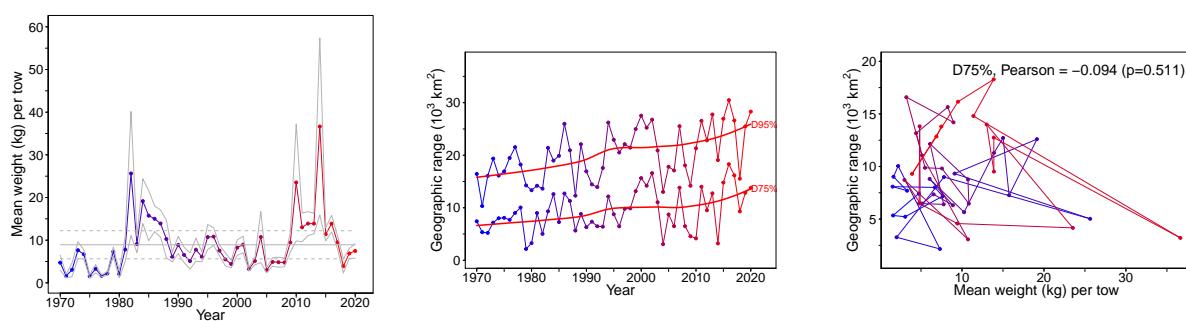


Figure 7.5B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Silver hake.

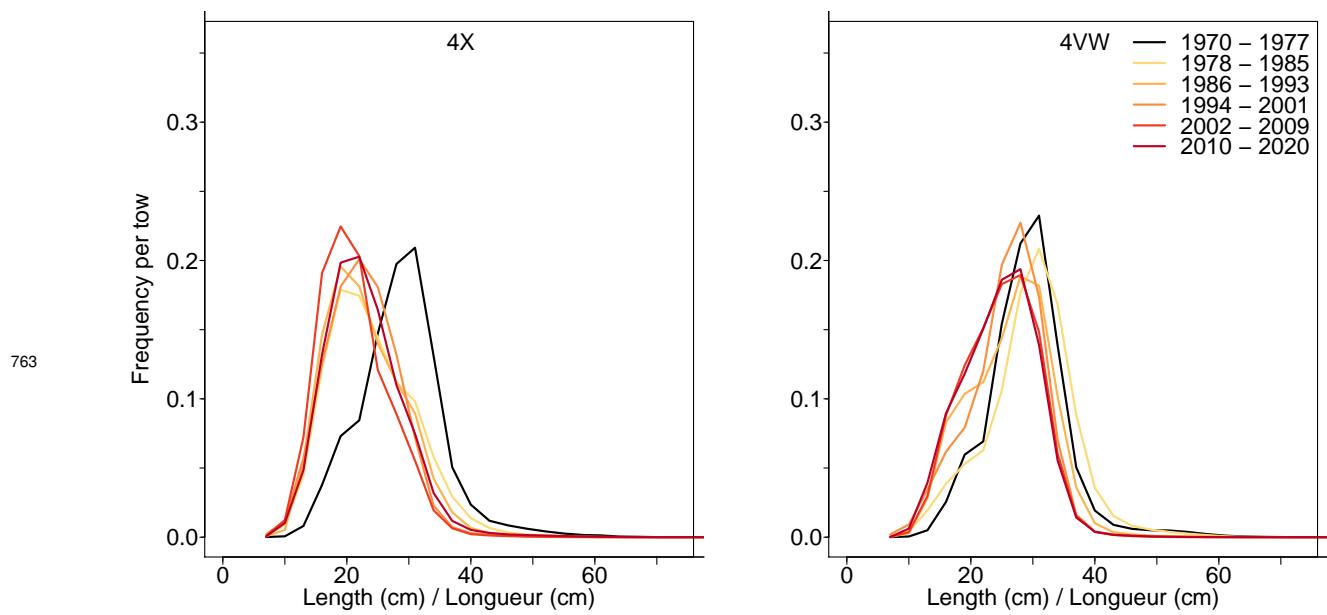


Figure 7.5C. Length frequency distribution in NAFO units 4X and 4VW for Silver hake.

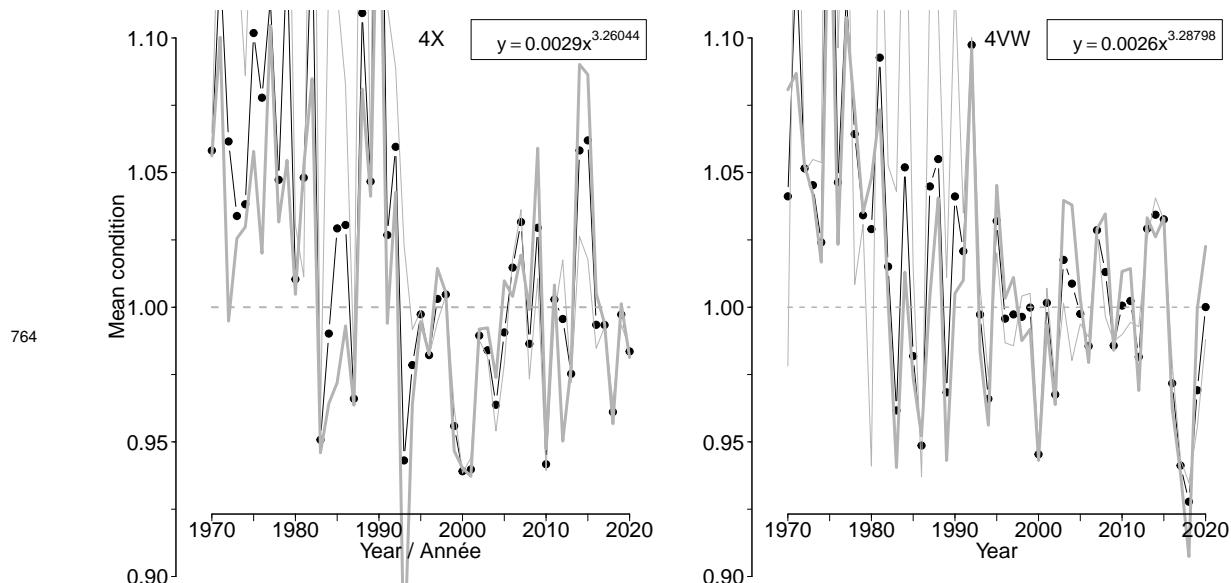
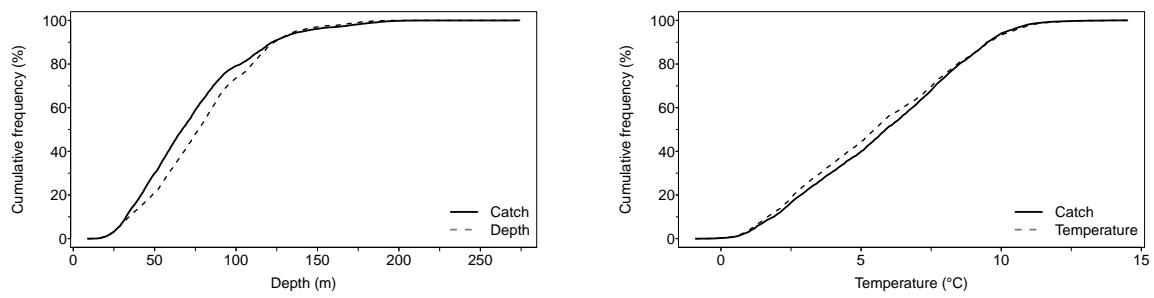
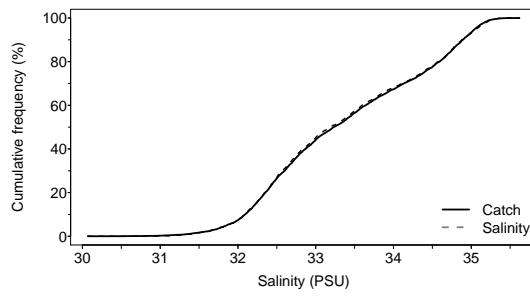


Figure 7.5D. Average fish condition in NAFO units 4X and 4VW for Silver hake.



765



Freq	Depth	Temp	Sal
F5	28	1.2	31.00
F25	55	3.1	32.46
F50	77	5.5	33.20
F75	104	8.0	34.37
F95	137	10.0	35.07

Figure 7.5E. Catch distribution by depth, temperature and salinity of Silver hake.

766

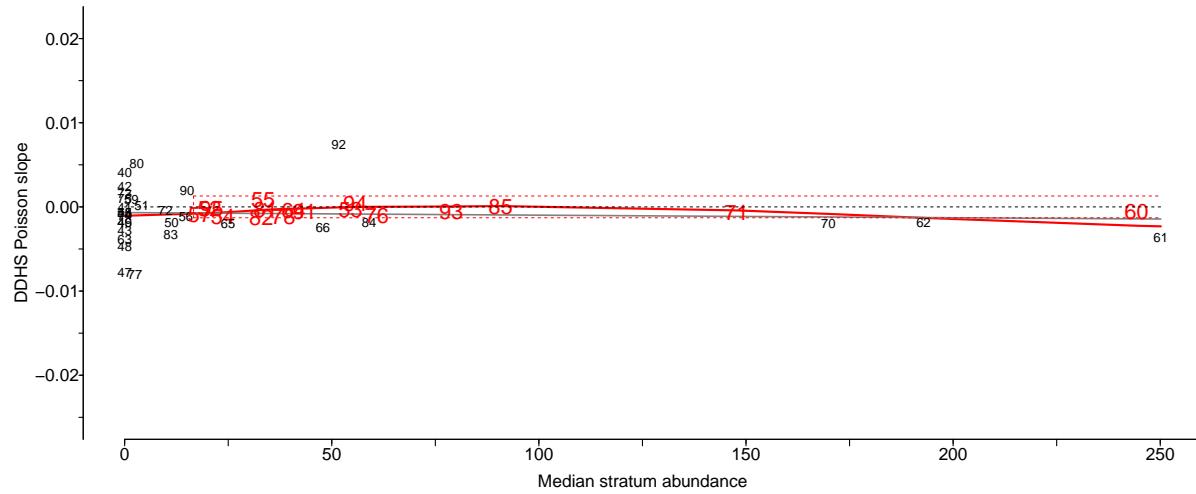


Figure 7.5F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Silver hake.

767

## 7.6 Pollock (Goberge) - species code 16 (category LF)

768

Scientific name: [Pollachius virens](#)

769

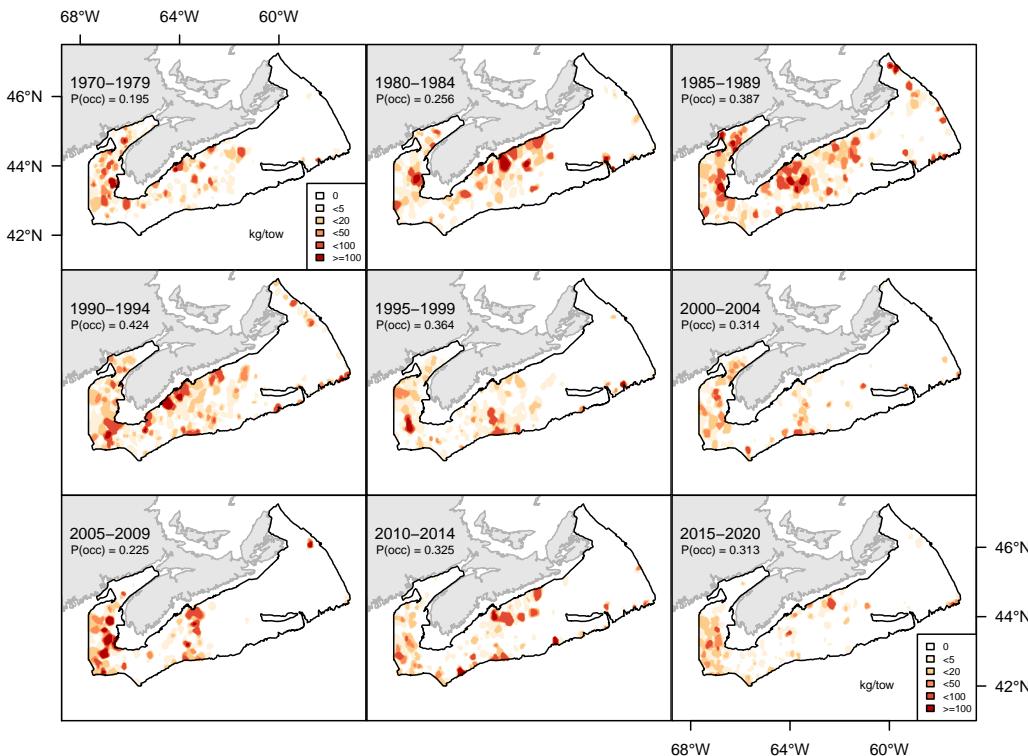


Figure 7.6A. Inverse distance weighted distribution of catch biomass (kg/tow) for Pollock.

770

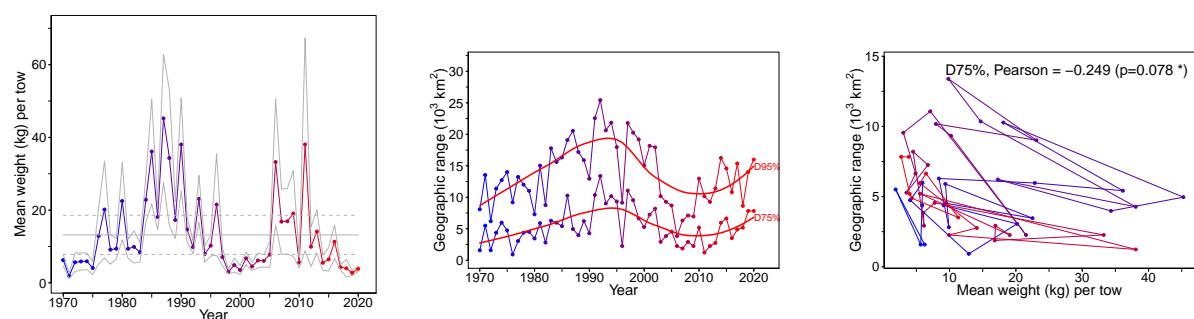


Figure 7.6B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Pollock.

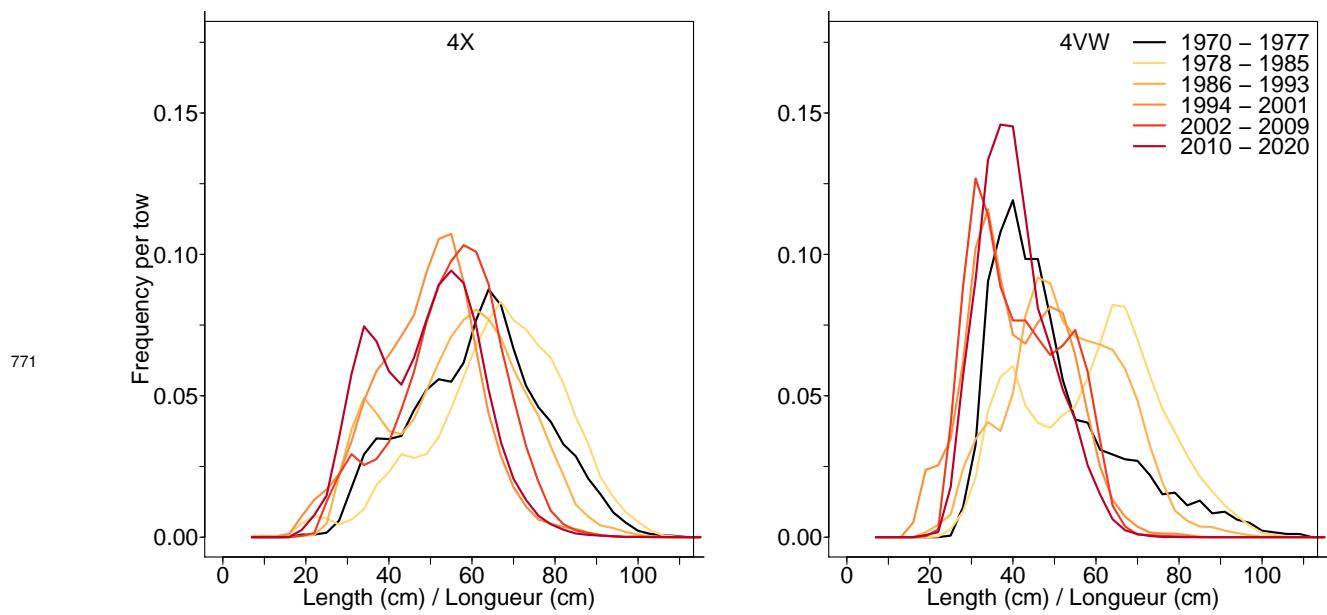


Figure 7.6C. Length frequency distribution in NAFO units 4X and 4VW for Pollock.

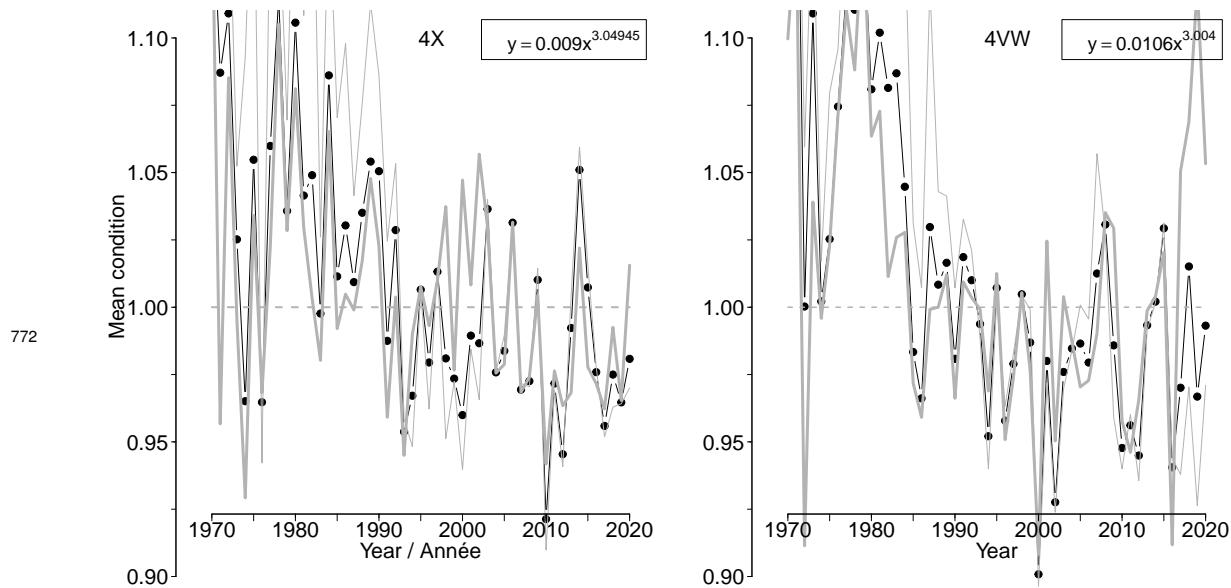
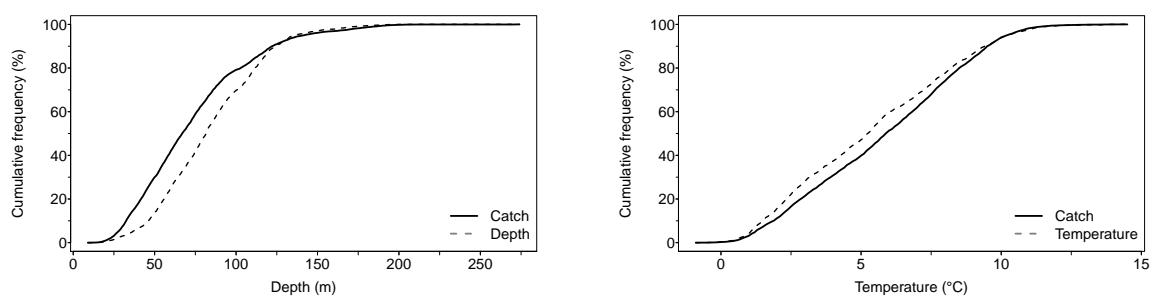
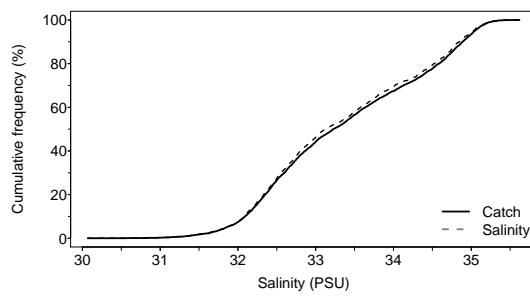


Figure 7.6D. Average fish condition in NAFO units 4X and 4VW for Pollock.



773



Freq	Depth	Temp	Sal
F5	37	1.1	31.00
F25	60	2.8	32.45
F50	82	5.3	33.14
F75	108	7.7	34.33
F95	137	10.0	35.03

Figure 7.6E. Catch distribution by depth, temperature and salinity of Pollock.

774

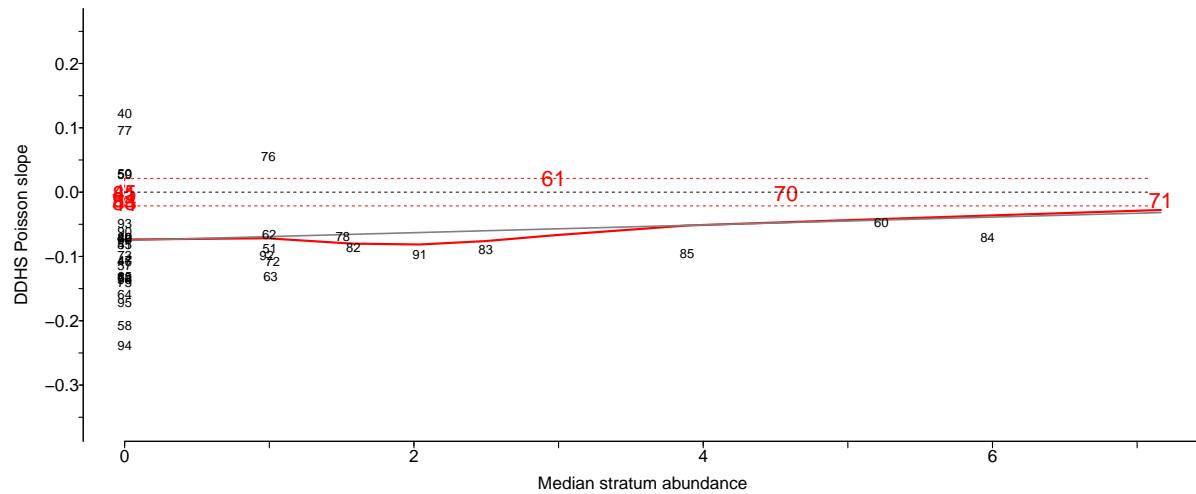


Figure 7.6F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Pollock.

775

## 7.7 Atlantic redfishes (Sébastes de l'Atlantique) - species code 23 (category LF)

776

Scientific name: [Sebastes](#)

777

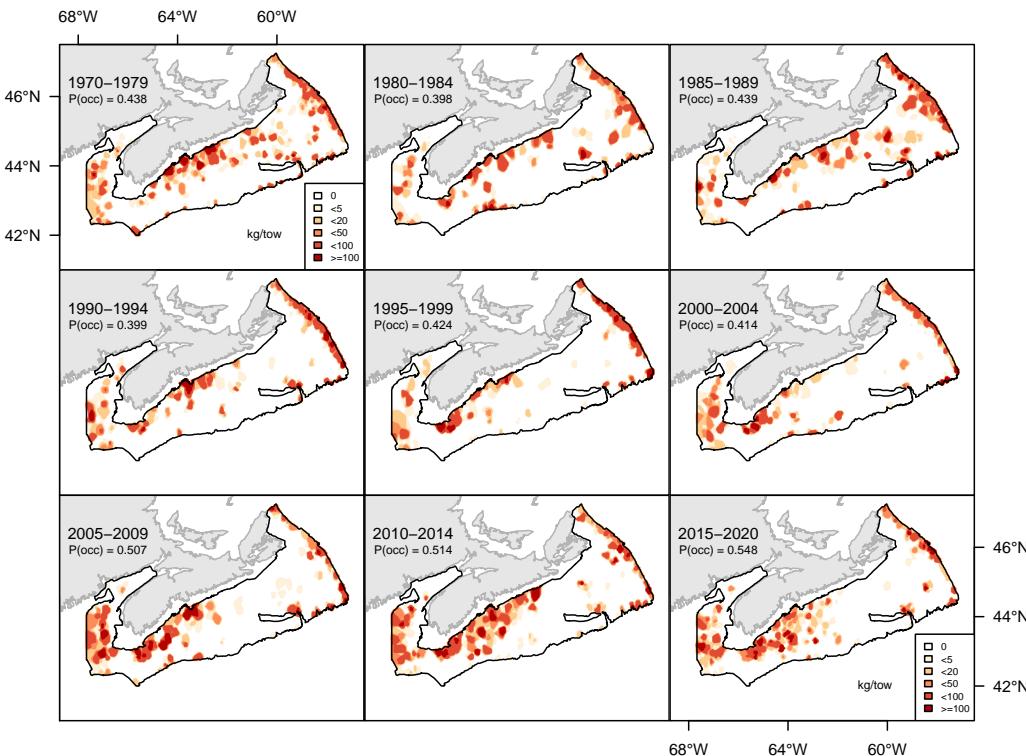


Figure 7.7A. Inverse distance weighted distribution of catch biomass (kg/tow) for Atlantic redfishes.

778

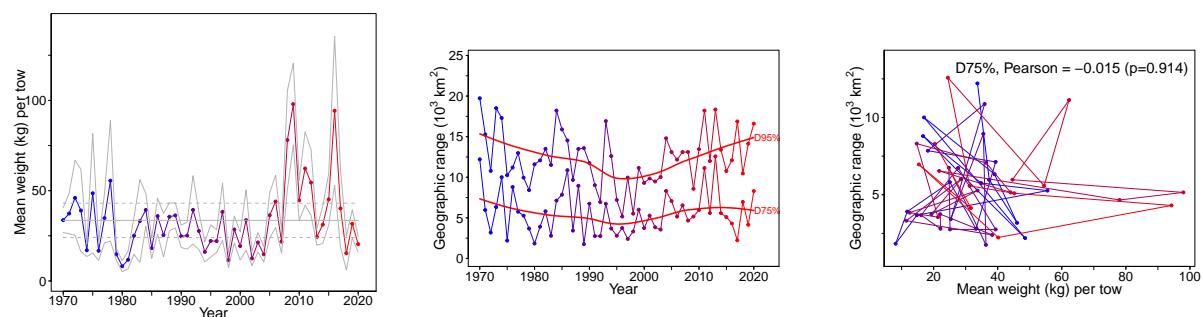


Figure 7.7B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Atlantic redfishes.

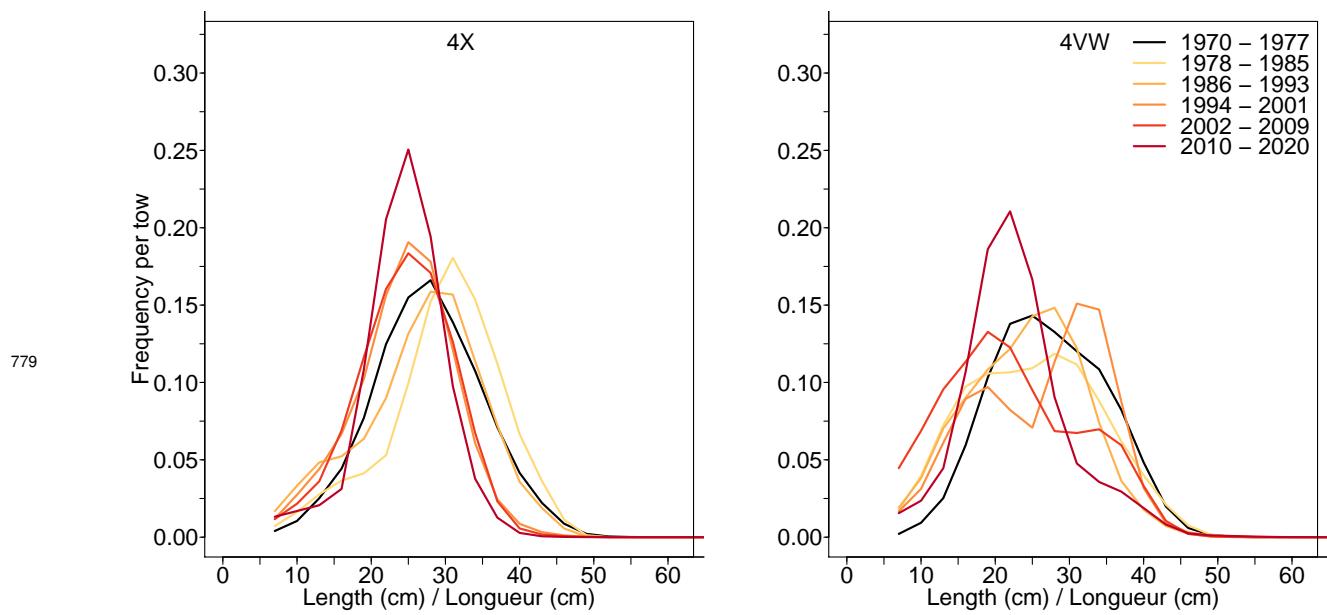


Figure 7.7C. Length frequency distribution in NAFO units 4X and 4VW for Atlantic redfishes.

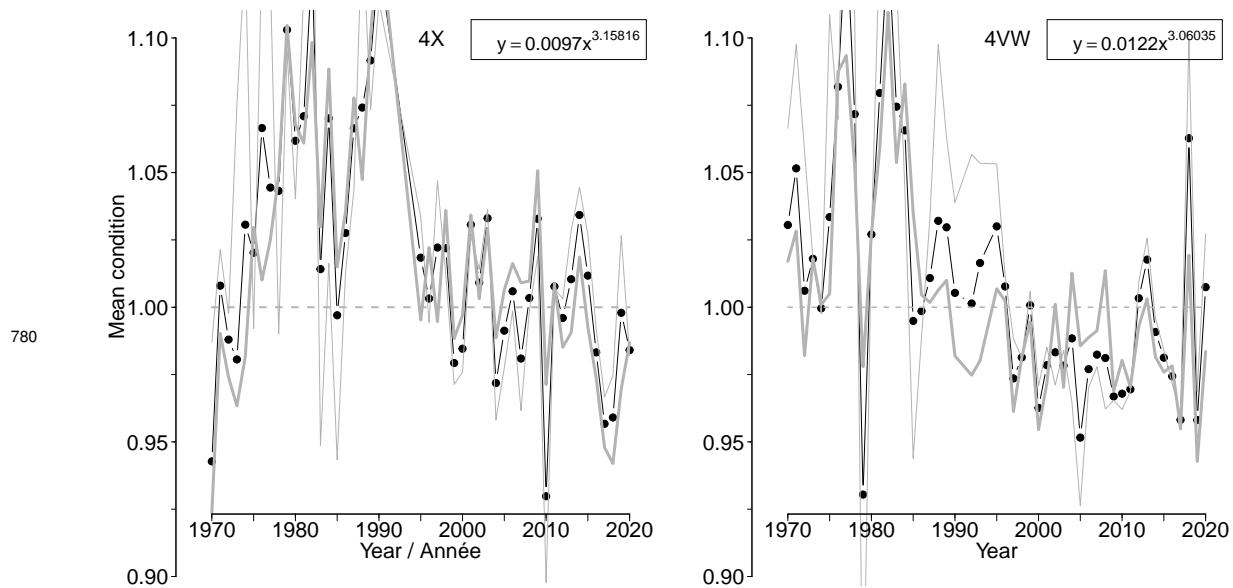
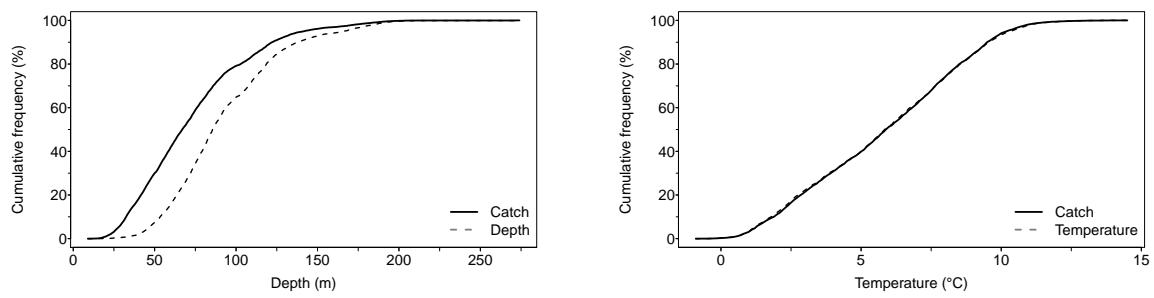
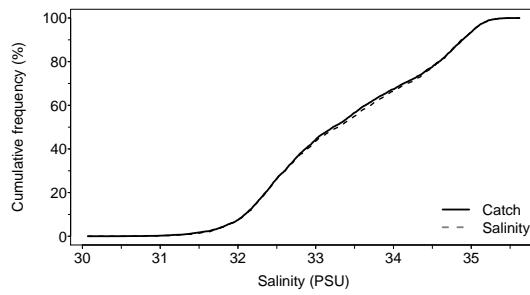


Figure 7.7D. Average fish condition in NAFO units 4X and 4VW for Atlantic redfishes.



781



Freq	Depth	Temp	Sal
F5	47	1.2	31.00
F25	68	3.4	32.48
F50	86	5.9	33.29
F75	114	8.1	34.41
F95	166	10.0	35.05

Figure 7.7E. Catch distribution by depth, temperature and salinity of Atlantic redfishes.

782

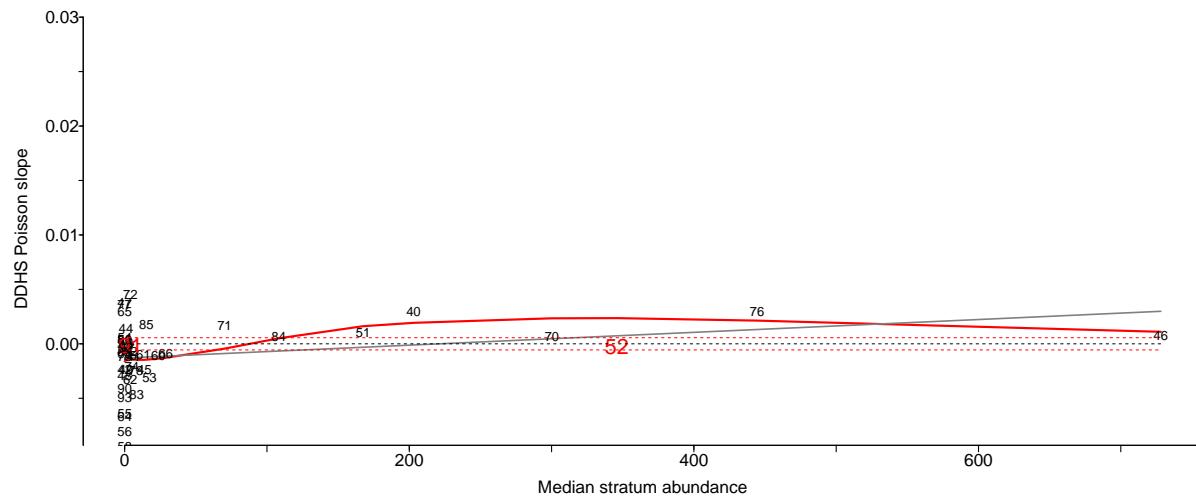


Figure 7.7F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Atlantic redfishes.

783

## 7.8 Atlantic halibut (Flétan de l'Atlantique) - species code 30 (category LF)

784

Scientific name: [Hippoglossus hippoglossus](#)

785

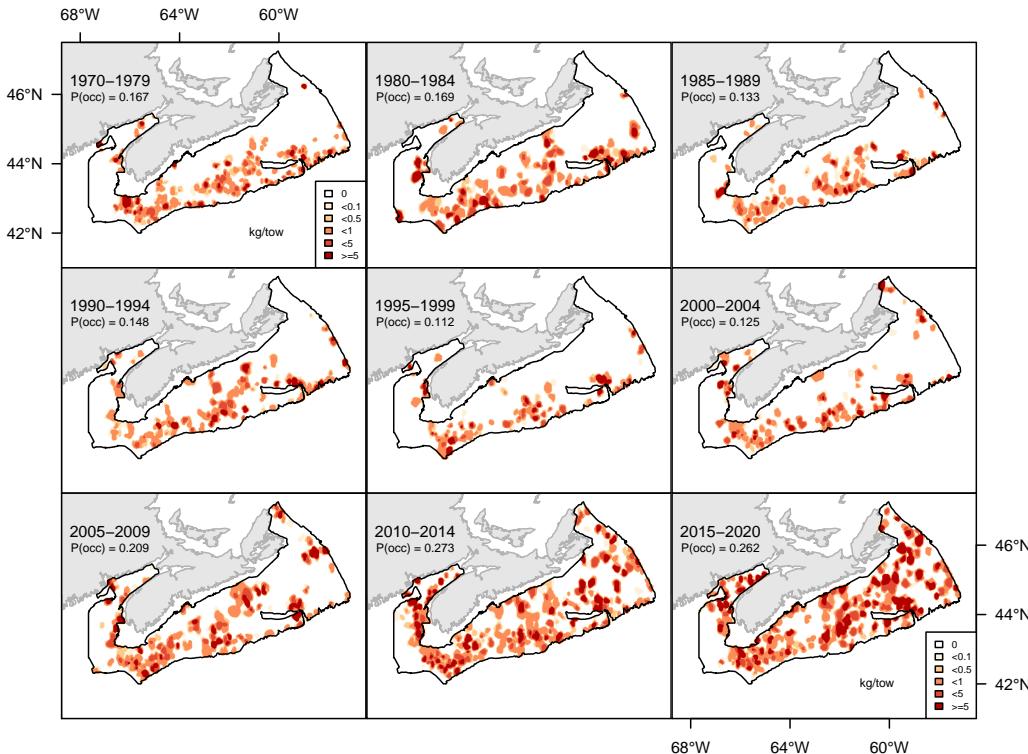


Figure 7.8A. Inverse distance weighted distribution of catch biomass (kg/tow) for Atlantic halibut.

786

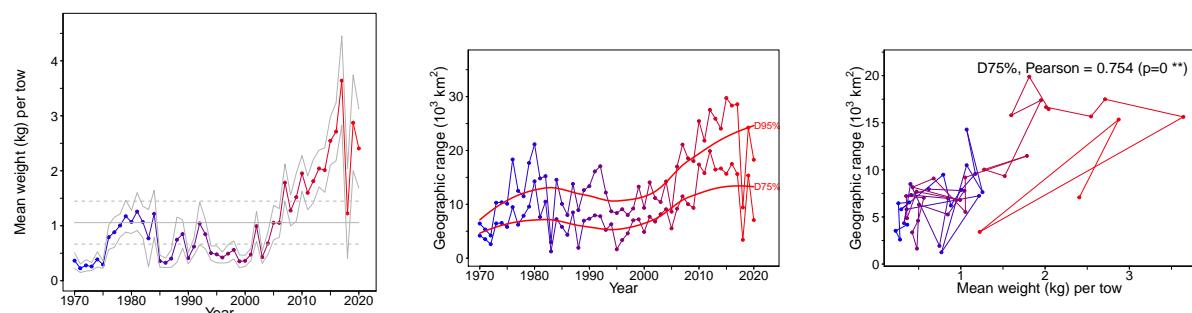


Figure 7.8B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Atlantic halibut.

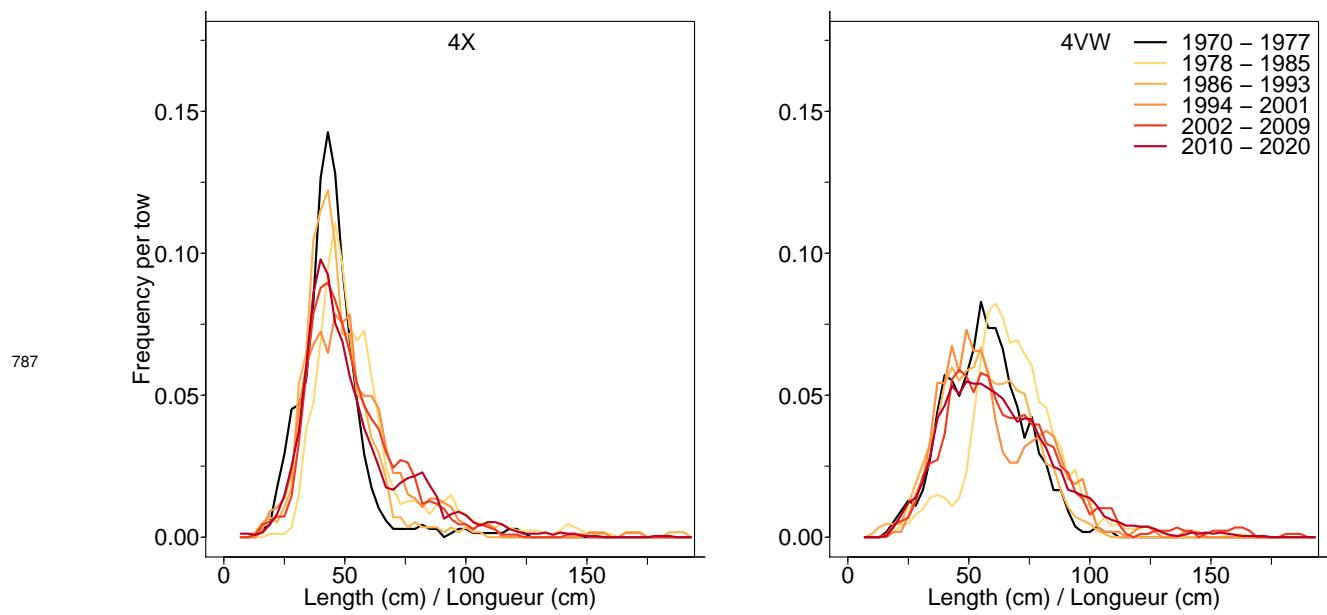


Figure 7.8C. Length frequency distribution in NAFO units 4X and 4VW for Atlantic halibut.

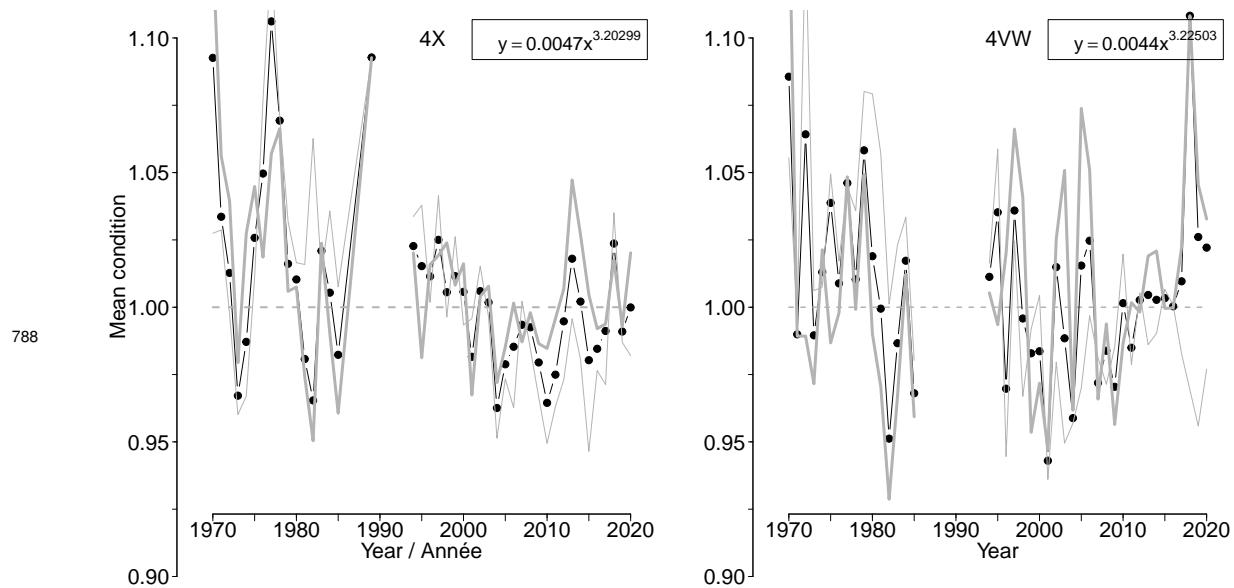
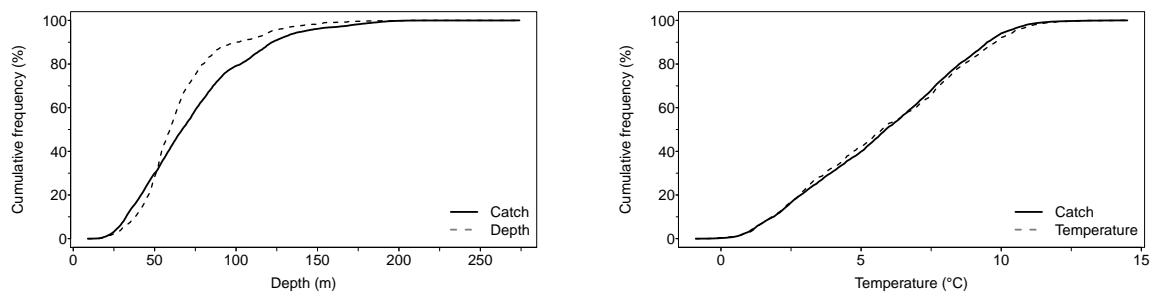
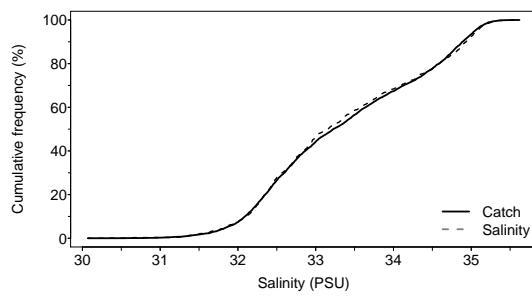


Figure 7.8D. Average fish condition in NAFO units 4X and 4VW for Atlantic halibut.

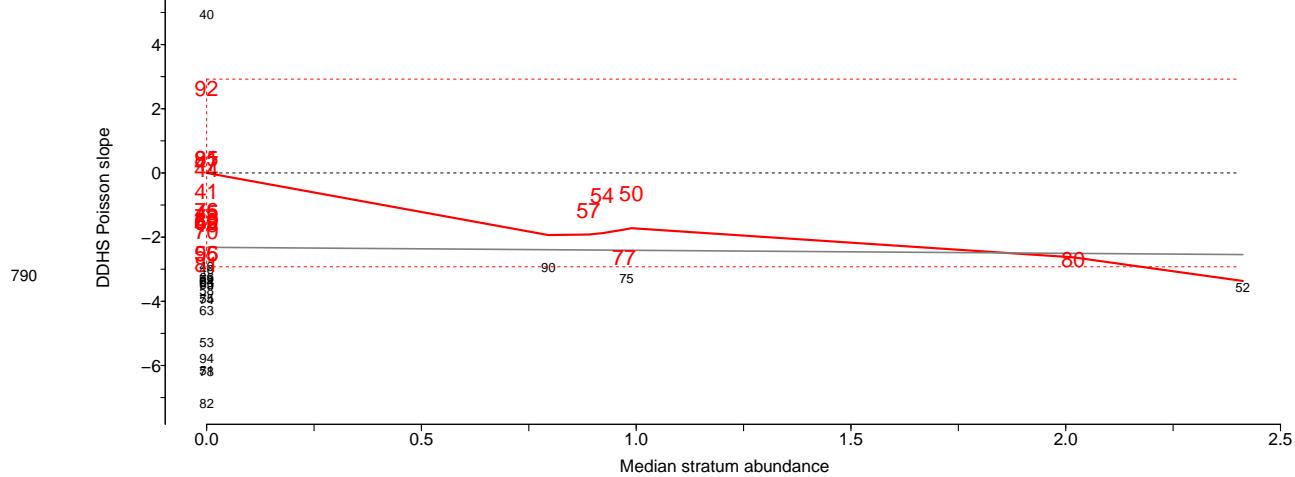


789



Freq	Depth	Temp	Sal
F5	31	1.3	31.00
F25	49	3.2	32.45
F50	60	5.8	33.16
F75	75	8.3	34.34
F95	122	10.0	35.08

Figure 7.8E. Catch distribution by depth, temperature and salinity of Atlantic halibut.



790

Figure 7.8F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Atlantic halibut.

791

## 7.9 American plaice (*Ple canadienne*) - species code 40 (category LF)

792

Scientific name: [Hippoglossoides platessoides](#)

793

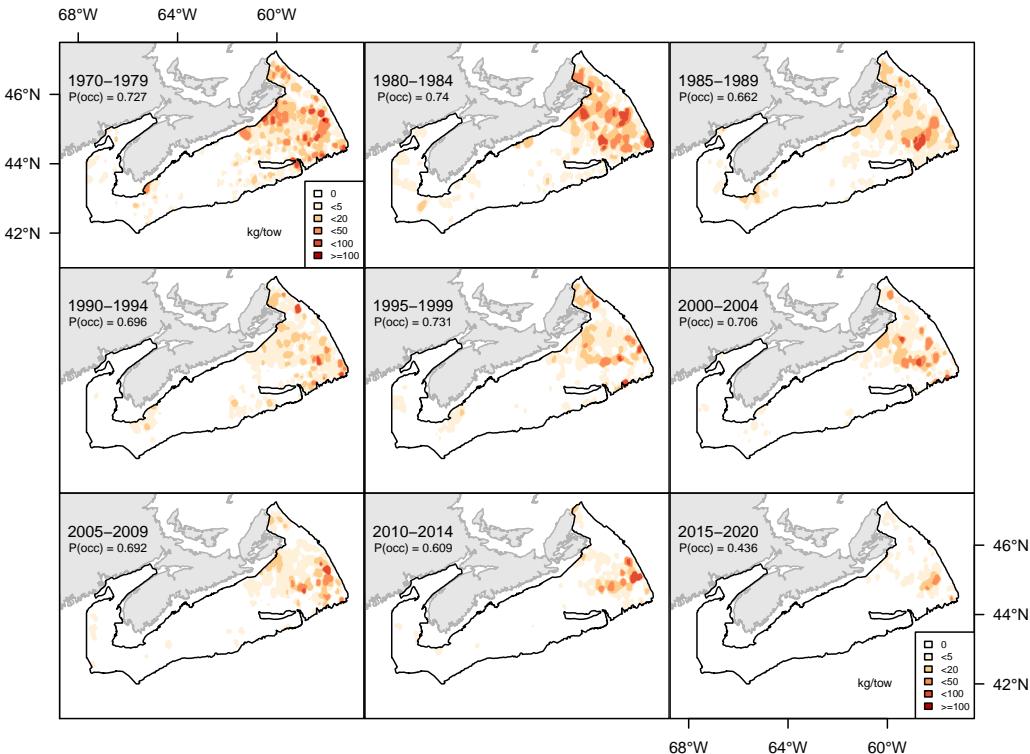


Figure 7.9A. Inverse distance weighted distribution of catch biomass (kg/tow) for American plaice.

794

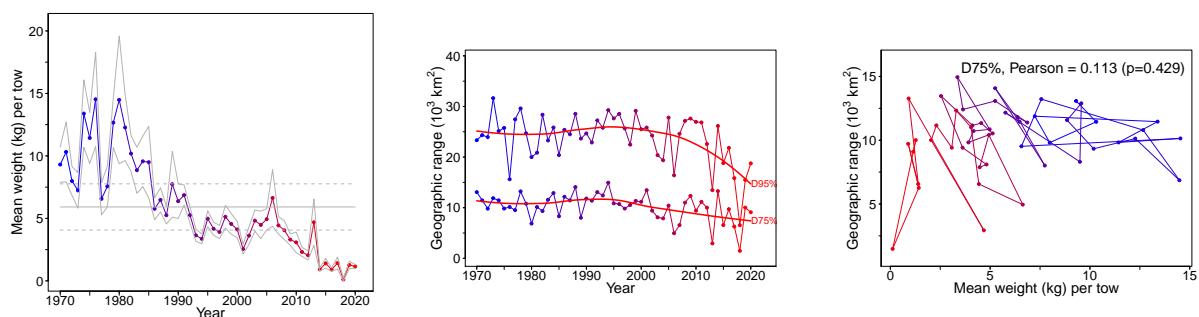


Figure 7.9B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of American plaice.

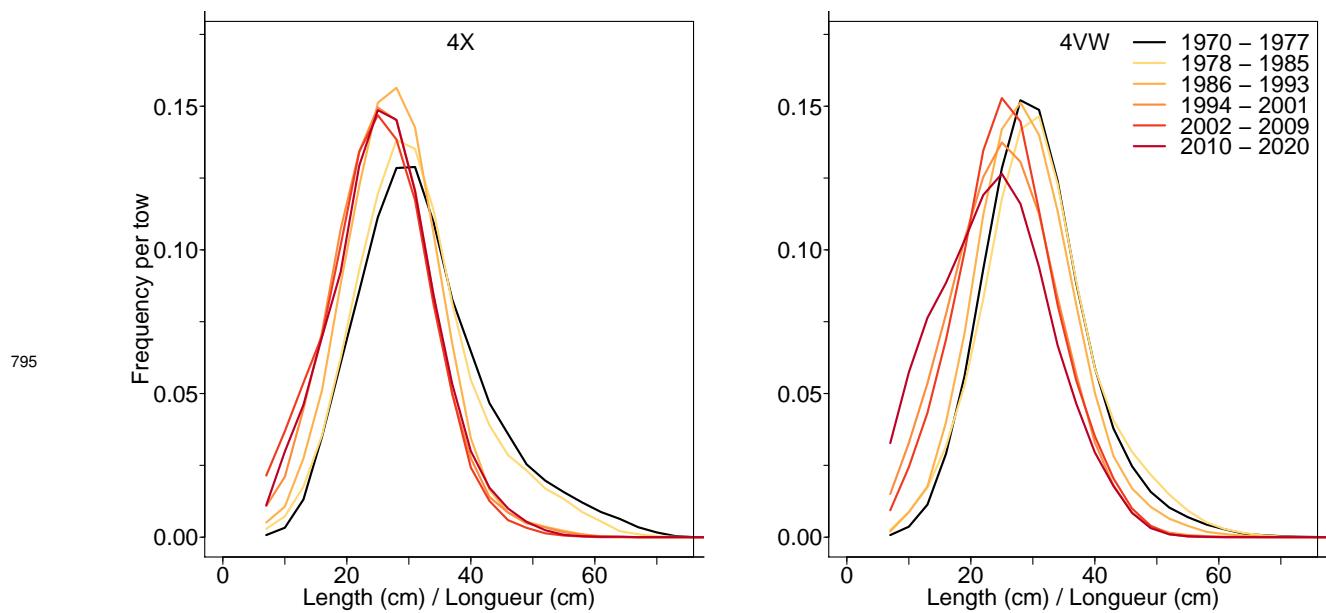


Figure 7.9C. Length frequency distribution in NAFO units 4X and 4VW for American plaice.

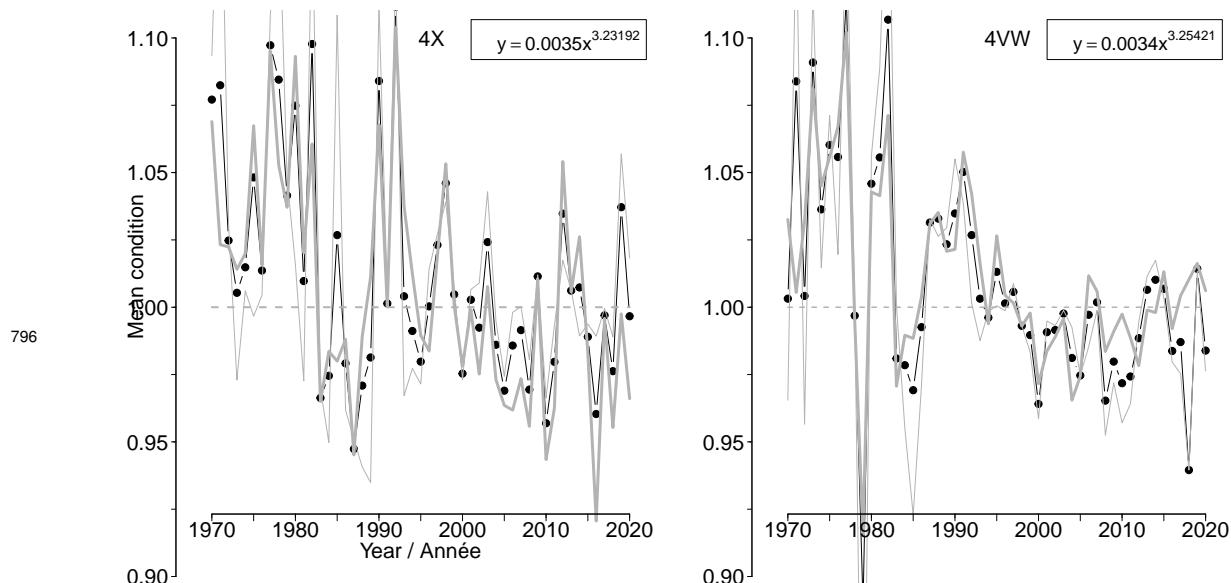
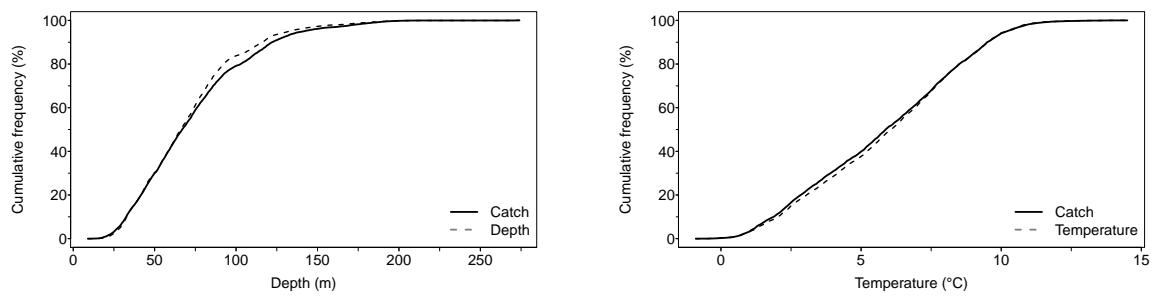
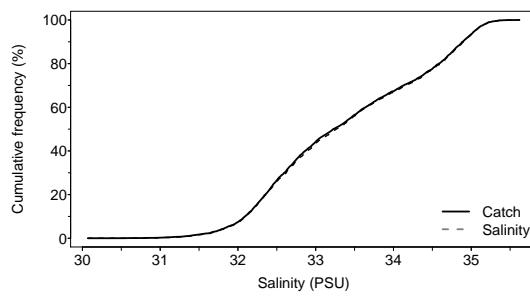


Figure 7.9D. Average fish condition in NAFO units 4X and 4VW for American plaice.



797



Freq	Depth	Temp	Sal
F5	29	1.3	31.00
F25	46	3.7	32.48
F50	67	6.1	33.27
F75	87	8.1	34.41
F95	133	10.0	35.05

Figure 7.9E. Catch distribution by depth, temperature and salinity of American plaice.

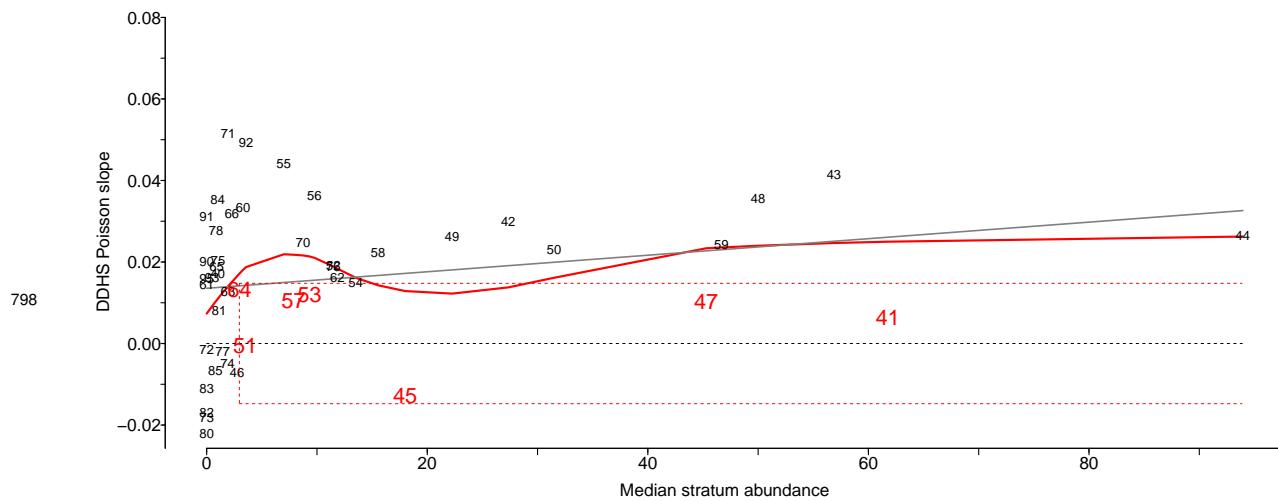


Figure 7.9F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for American plaice.

799

## 7.10 Witch flounder (*Ple grise*) - species code 41 (category LF)

800

Scientific name: [Glyptocephalus cynoglossus](#)

801

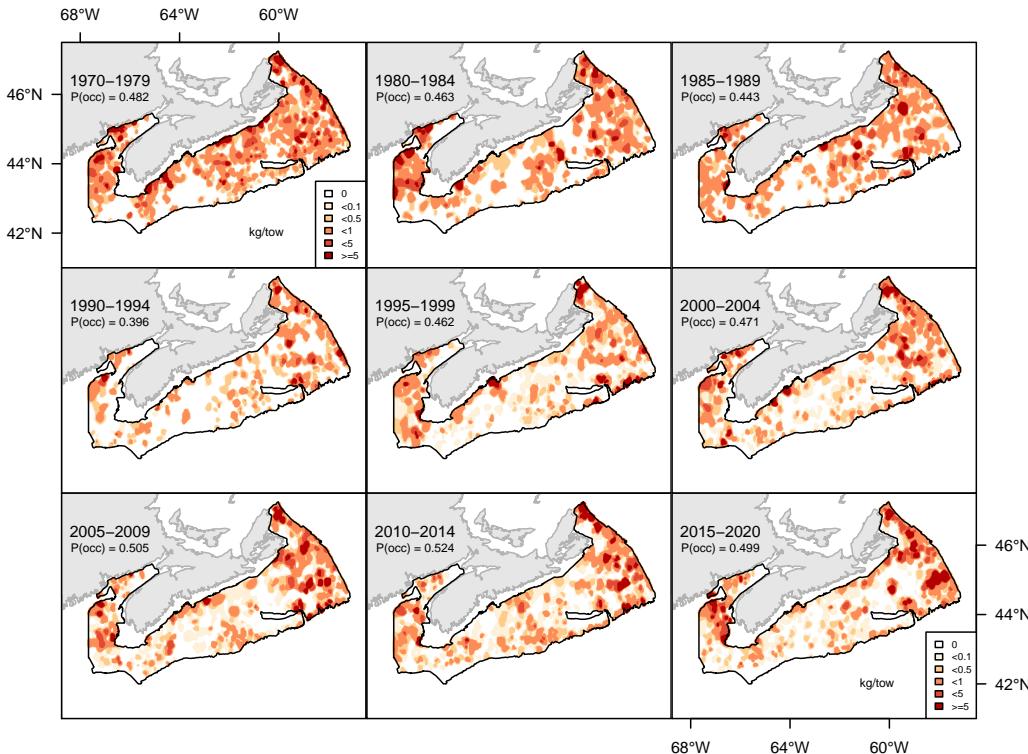


Figure 7.10A. Inverse distance weighted distribution of catch biomass (kg/tow) for Witch flounder.

802

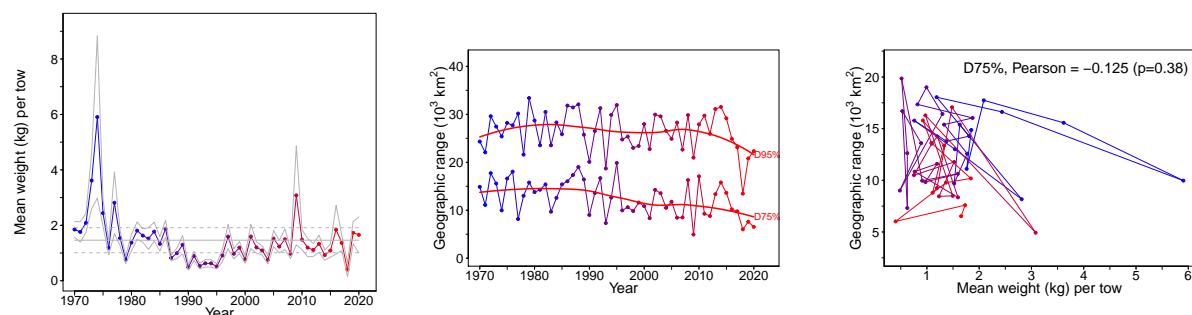


Figure 7.10B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Witch flounder.

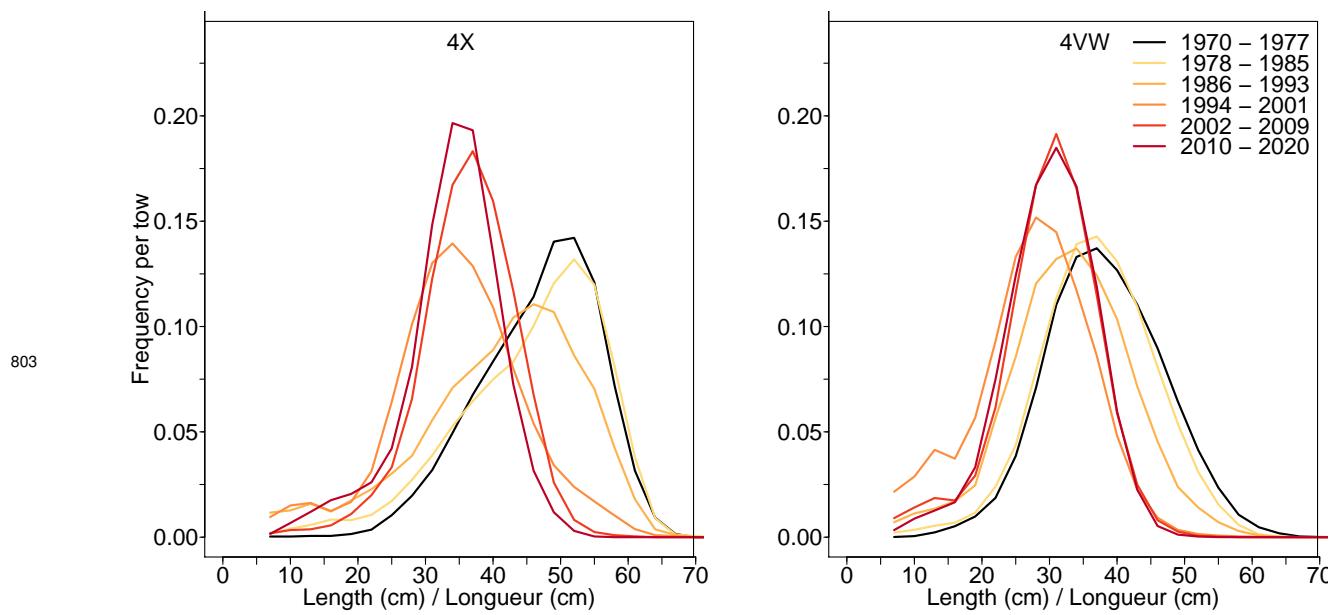


Figure 7.10C. Length frequency distribution in NAFO units 4X and 4VW for Witch flounder.

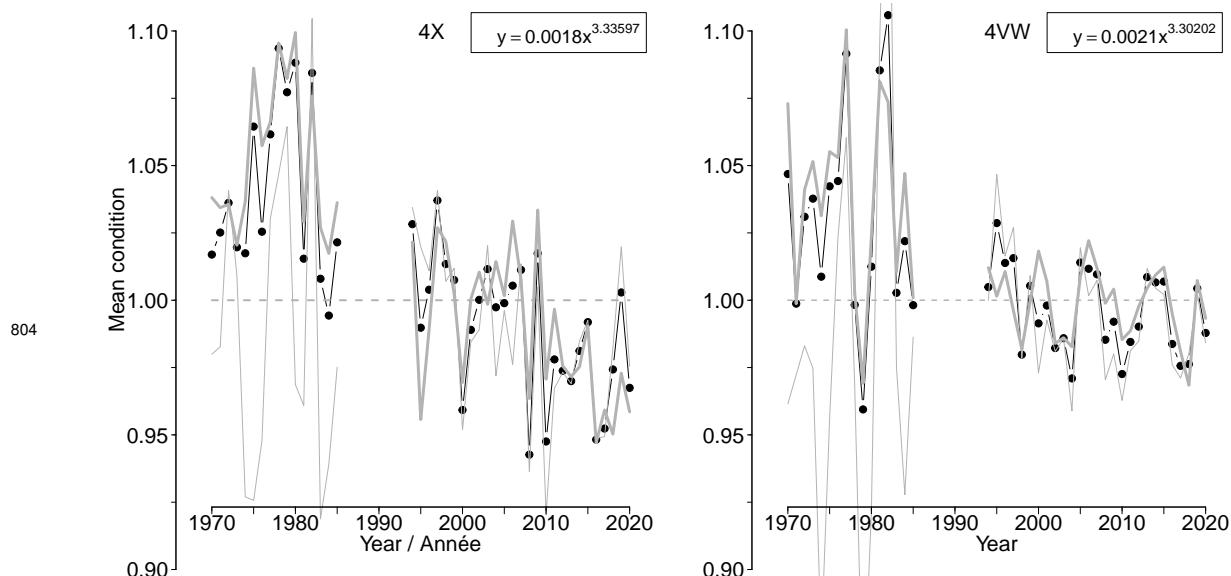


Figure 7.10D. Average fish condition in NAFO units 4X and 4VW for Witch flounder.

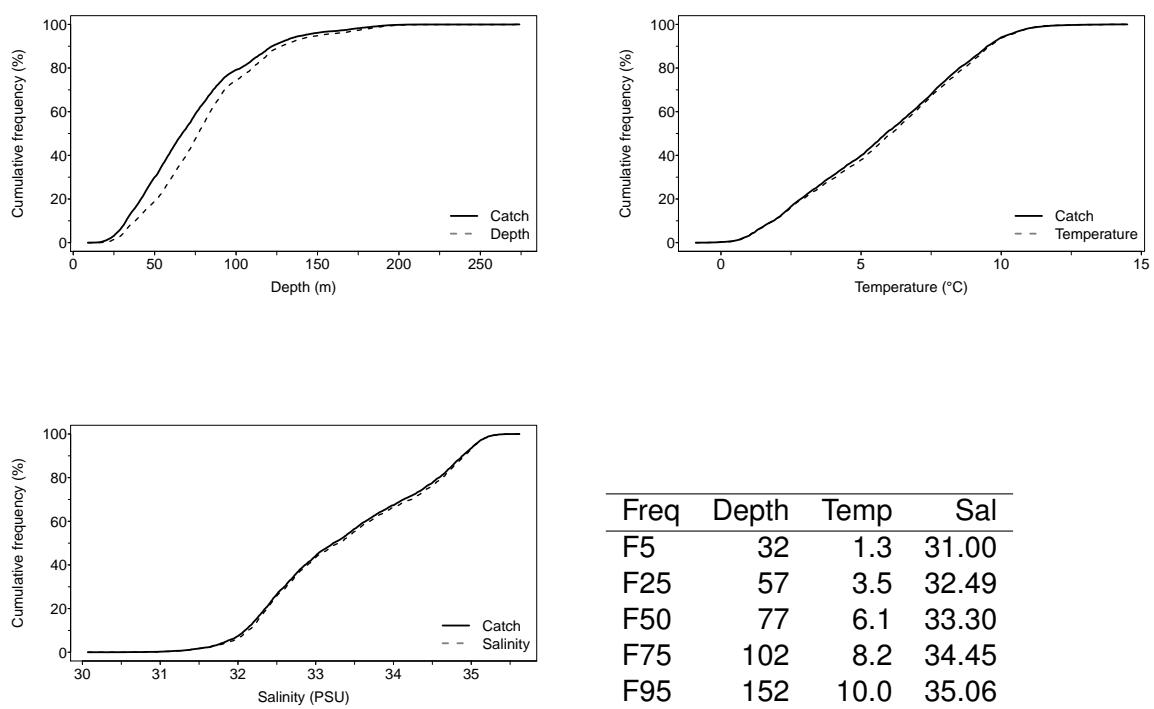


Figure 7.10E. Catch distribution by depth, temperature and salinity of Witch flounder.

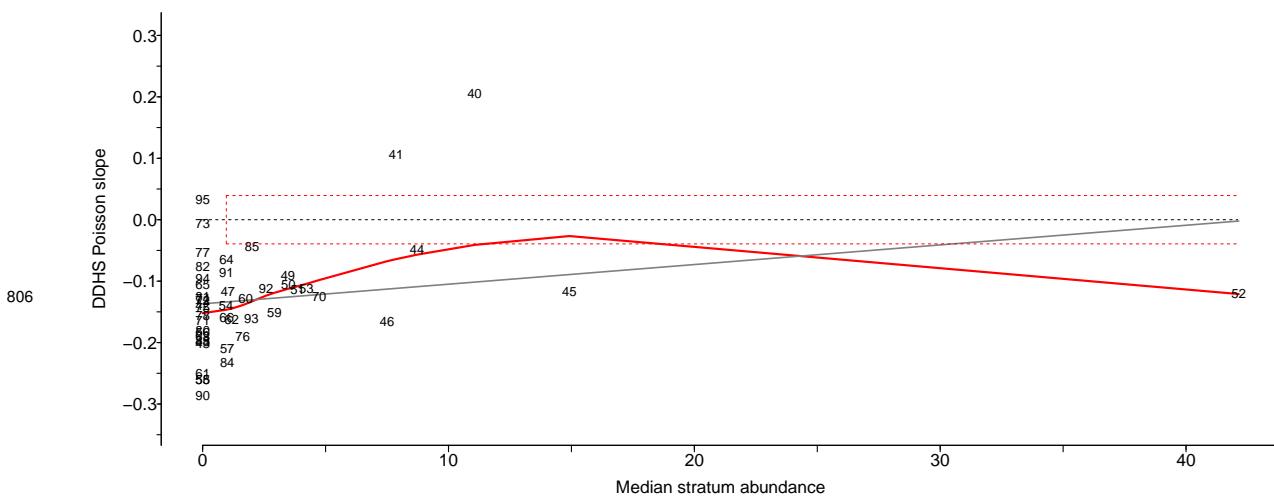


Figure 7.10F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Witch flounder.

807      **7.11 Yellowtail flounder (Limande à queue jaune) - species code 42 (category LF)**

808      Scientific name: [Limanda ferruginea](#)

809

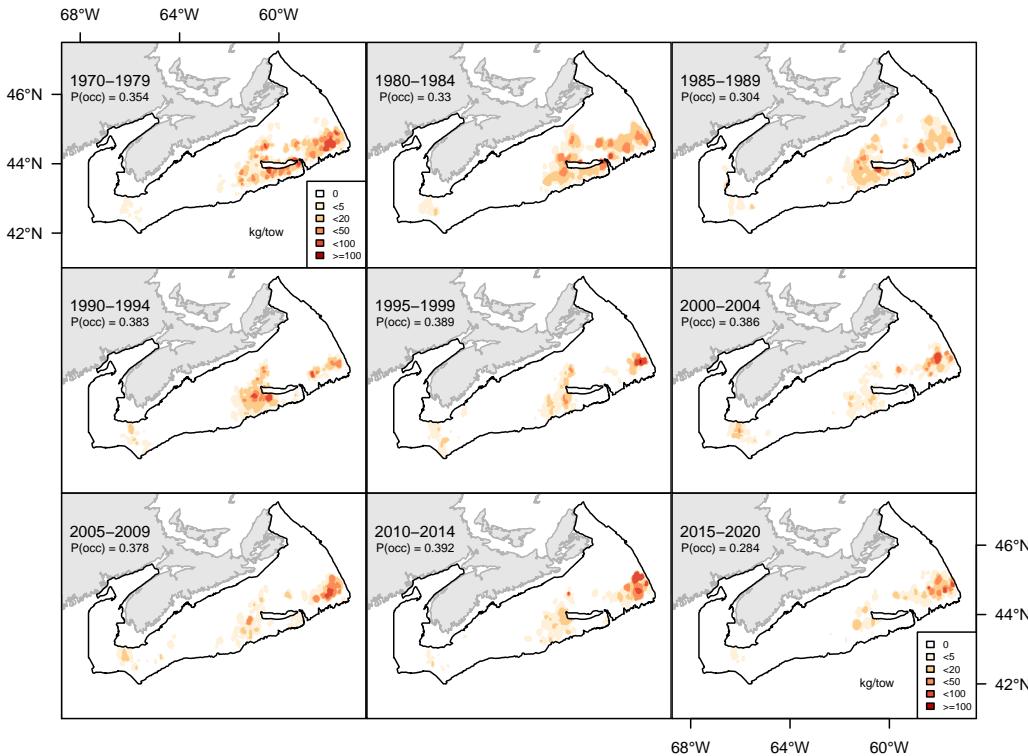


Figure 7.11A. Inverse distance weighted distribution of catch biomass (kg/tow) for Yellowtail flounder.

810

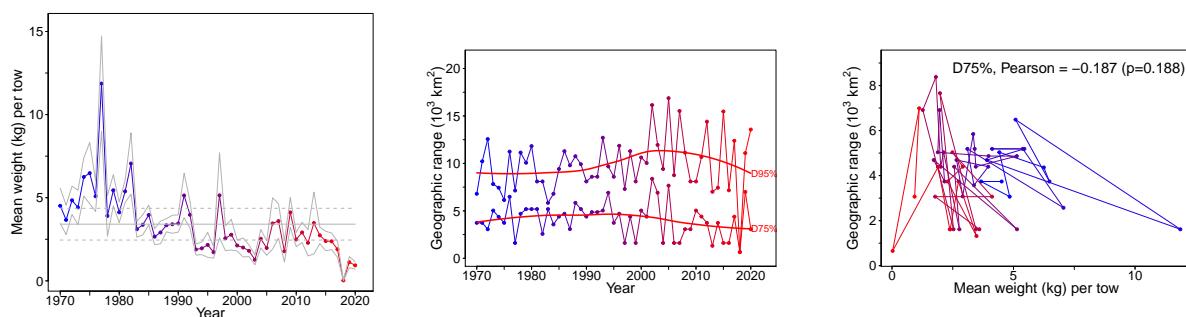


Figure 7.11B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Yellowtail flounder.

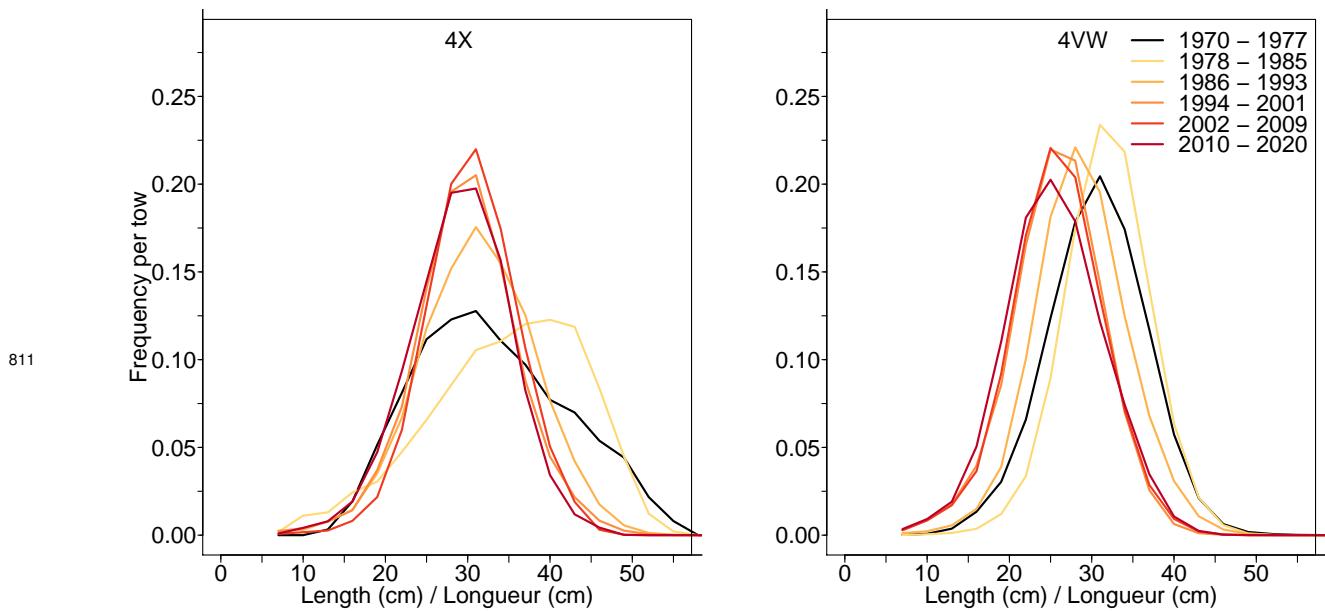


Figure 7.11C. Length frequency distribution in NAFO units 4X and 4VW for Yellowtail flounder.

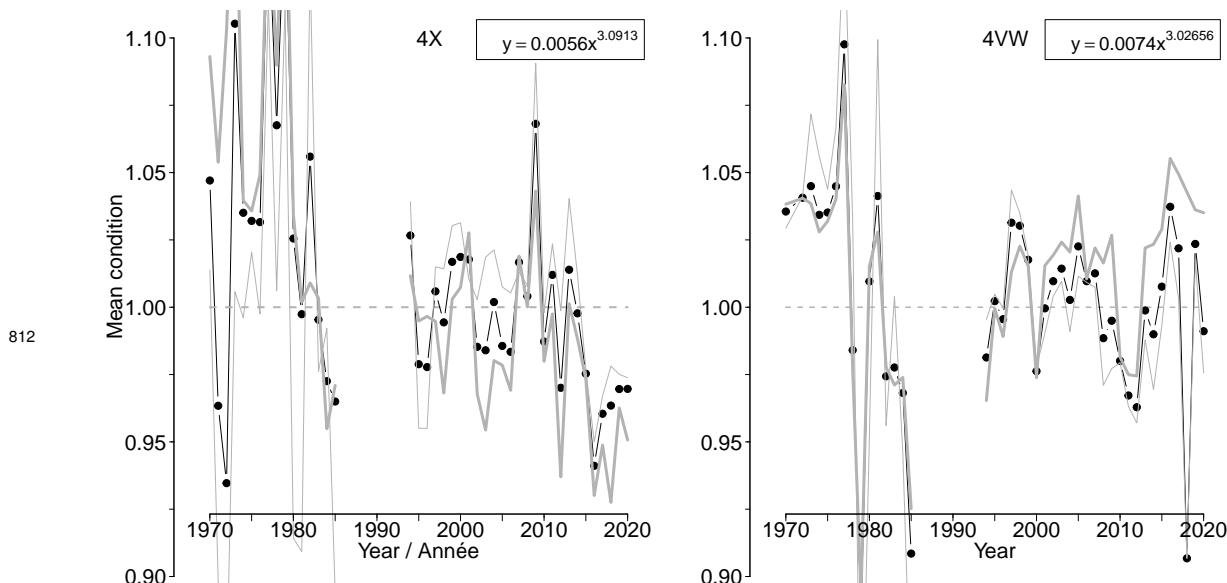
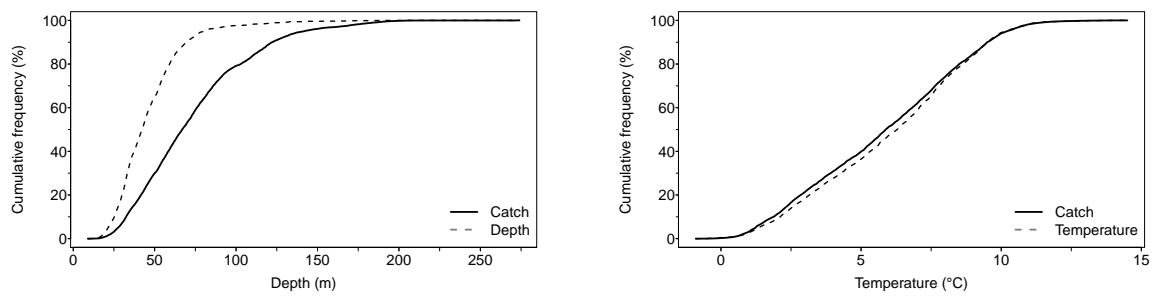
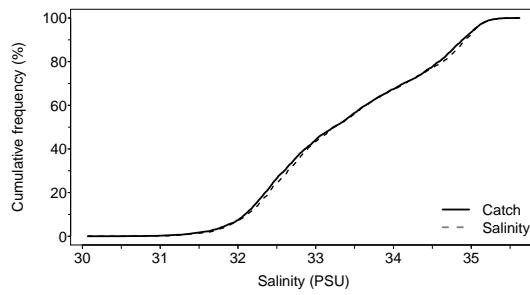


Figure 7.11D. Average fish condition in NAFO units 4X and 4VW for Yellowtail flounder.

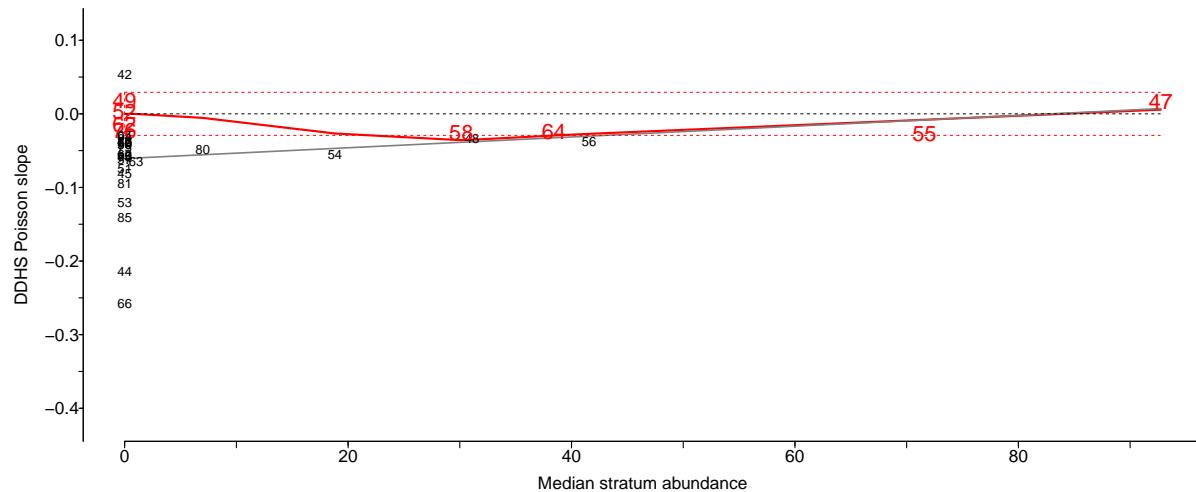


813



Freq	Depth	Temp	Sal
F5	22	1.4	31.00
F25	32	3.7	32.52
F50	43	6.3	33.25
F75	56	8.2	34.41
F95	81	10.0	35.06

Figure 7.11E. Catch distribution by depth, temperature and salinity of Yellowtail flounder.



814

Figure 7.11F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Yellowtail flounder.

815

## 7.12 Winter flounder (Limande-plie rouge) - species code 43 (category LF)

816

Scientific name: [Pseudopleuronectes americanus](#)

817

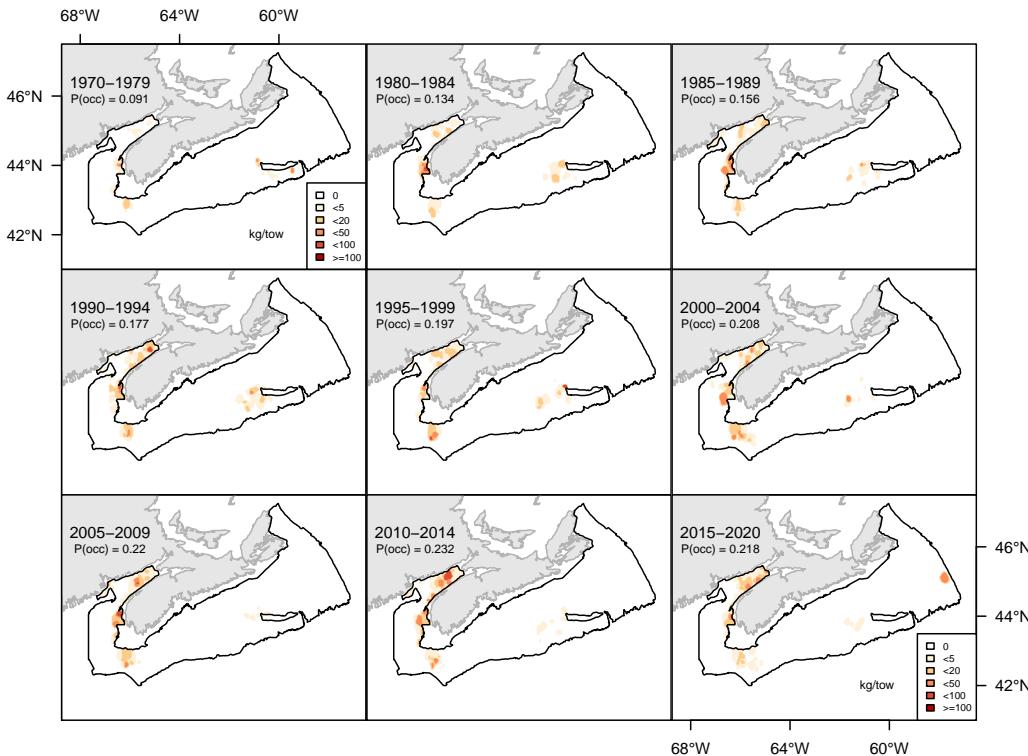


Figure 7.12A. Inverse distance weighted distribution of catch biomass (kg/tow) for Winter flounder.

818

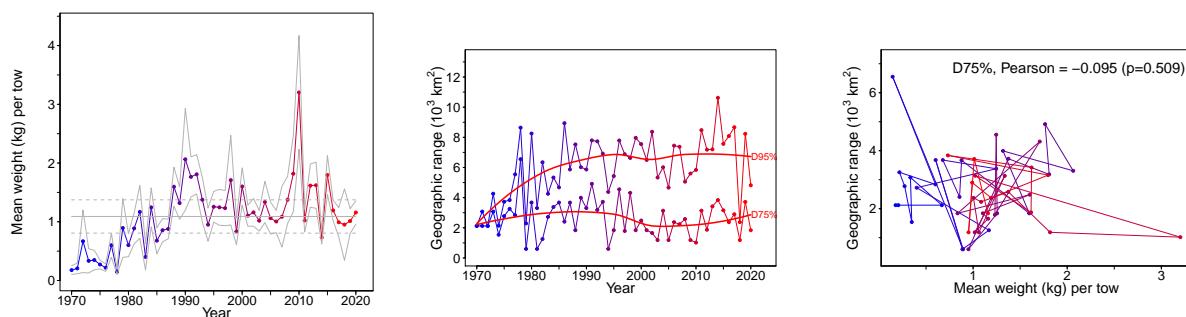


Figure 7.12B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Winter flounder.

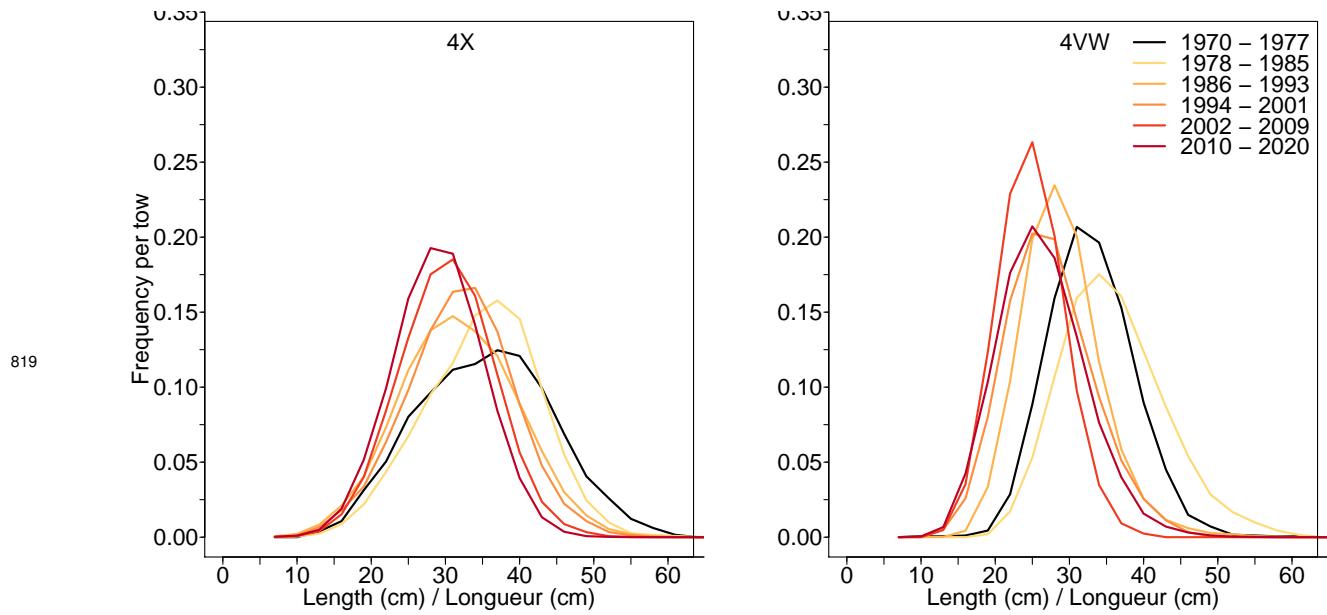


Figure 7.12C. Length frequency distribution in NAFO units 4X and 4VW for Winter flounder.

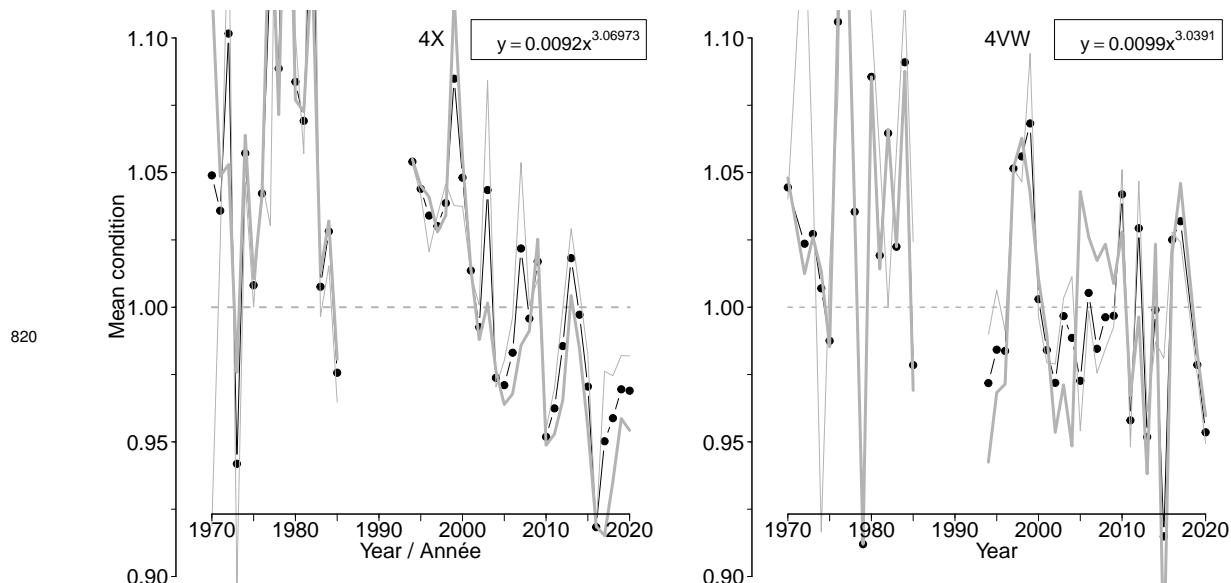
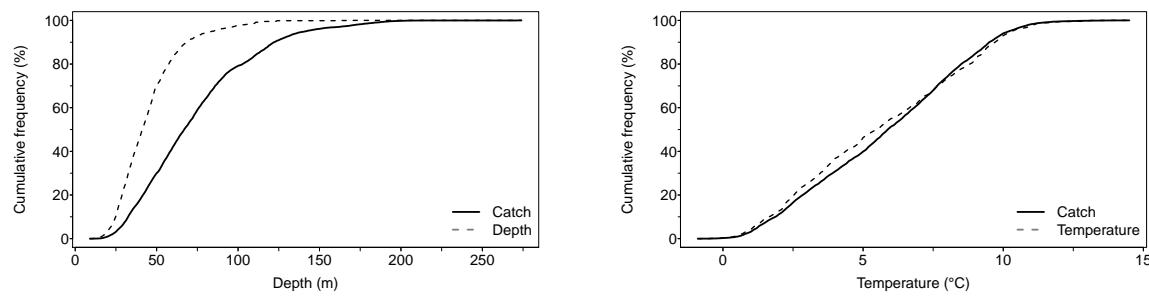
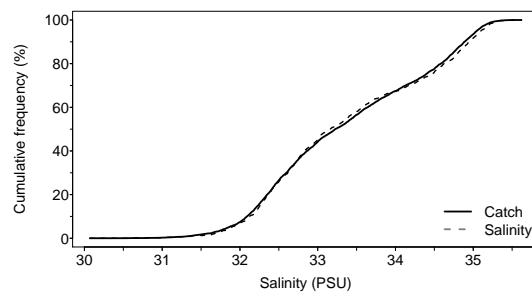


Figure 7.12D. Average fish condition in NAFO units 4X and 4VW for Winter flounder.



821



Freq	Depth	Temp	Sal
F5	22	1.1	31.00
F25	31	3.0	32.48
F50	42	5.5	33.17
F75	54	8.3	34.47
F95	84	10.0	35.10

Figure 7.12E. Catch distribution by depth, temperature and salinity of Winter flounder.

822

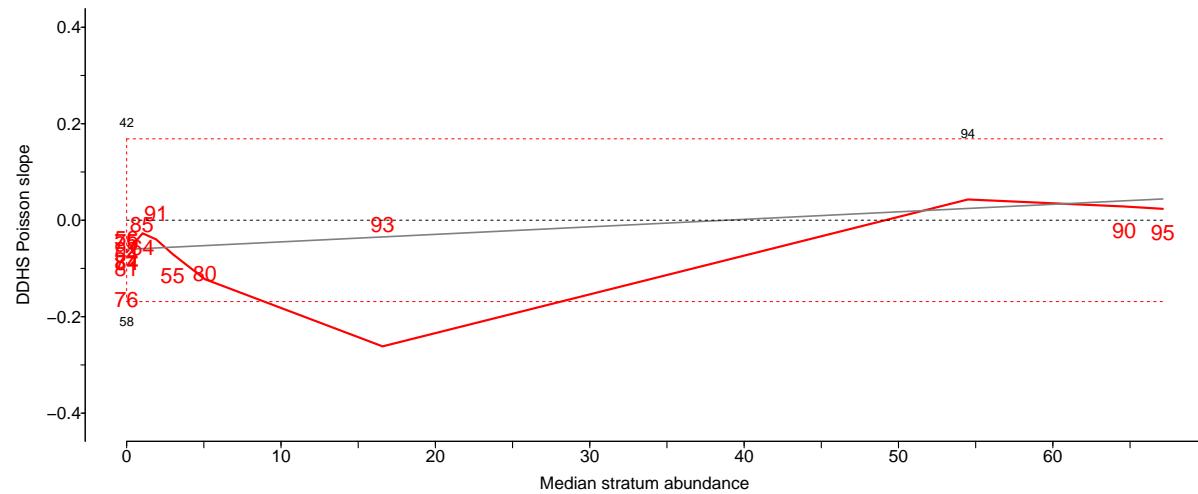


Figure 7.12F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Winter flounder.

823

## 7.13 Atlantic wolffish (*Loup atlantique*) - species code 50 (category LF)

824

Scientific name: [Anarhichas lupus](#)

825

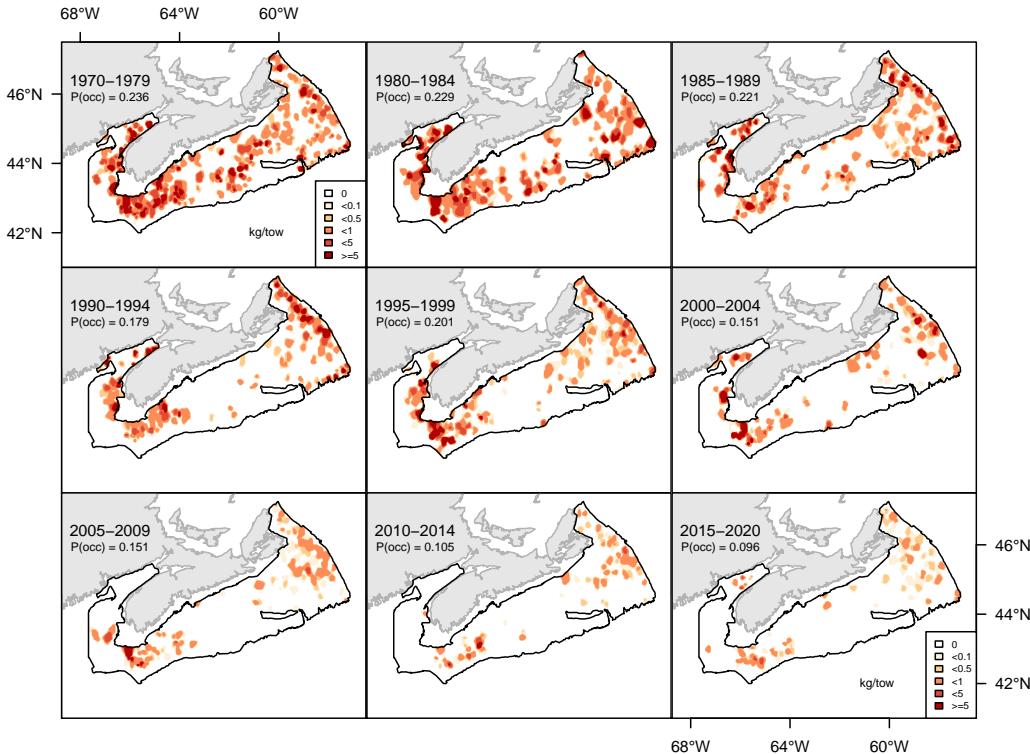


Figure 7.13A. Inverse distance weighted distribution of catch biomass (kg/tow) for Atlantic wolffish.

826

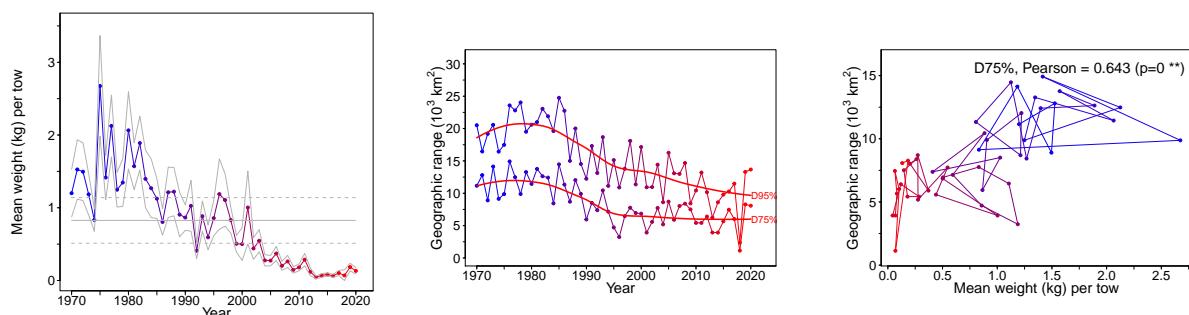


Figure 7.13B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Atlantic wolffish.

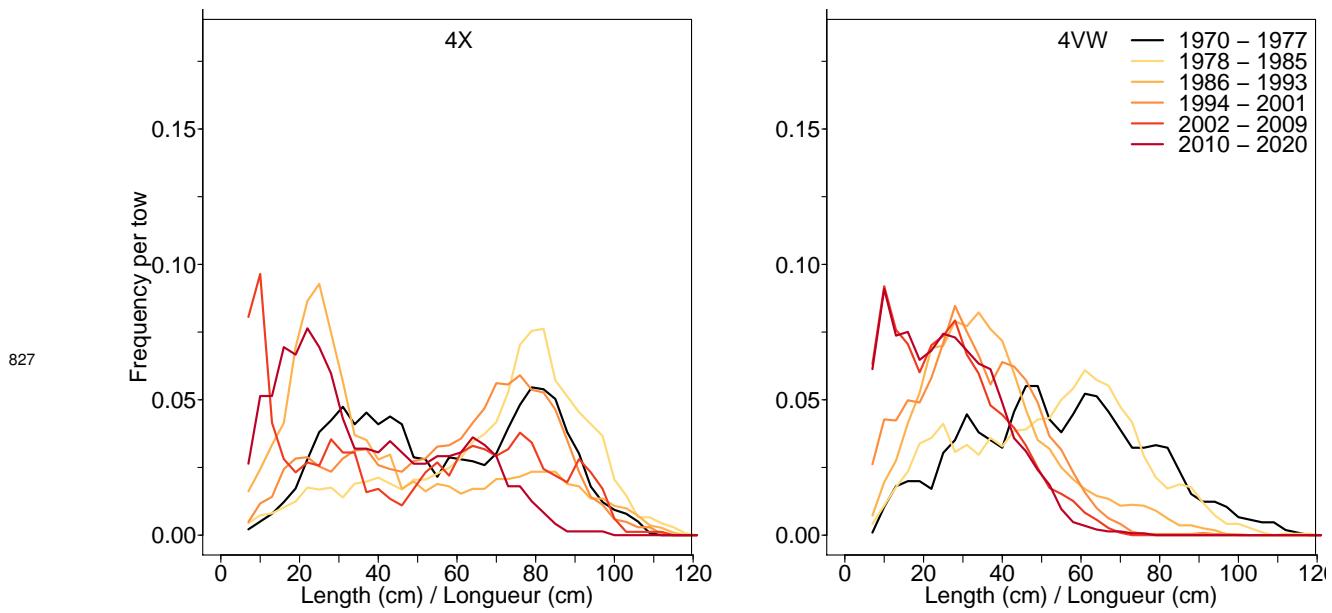


Figure 7.13C. Length frequency distribution in NAFO units 4X and 4VW for Atlantic wolffish.

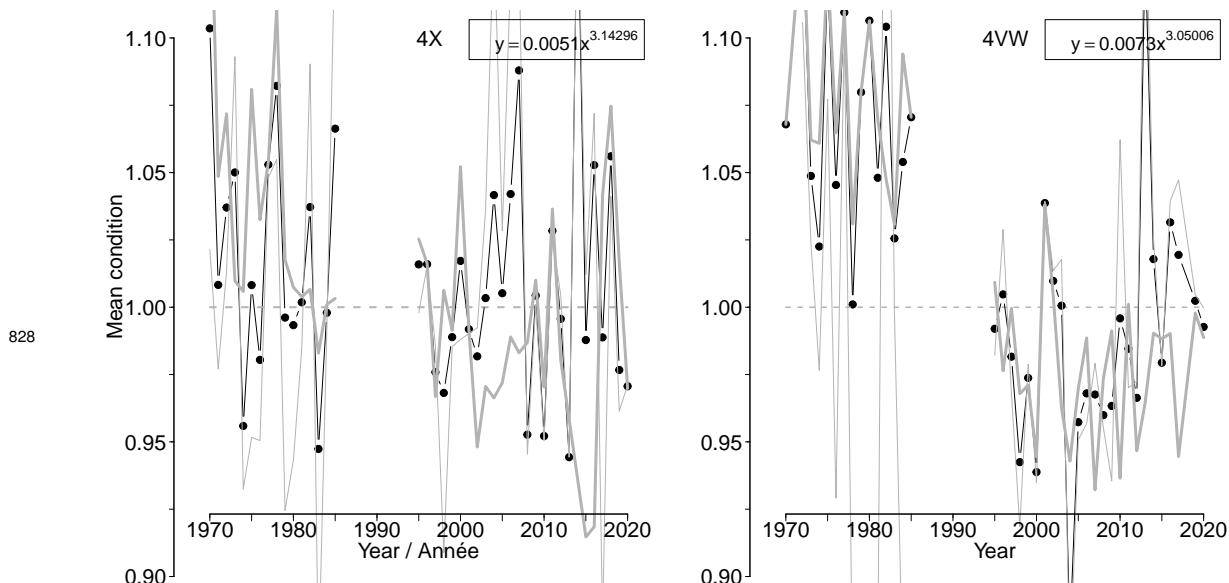
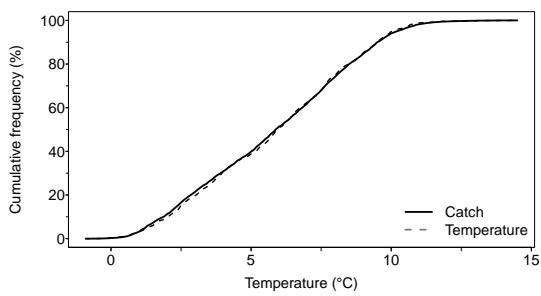
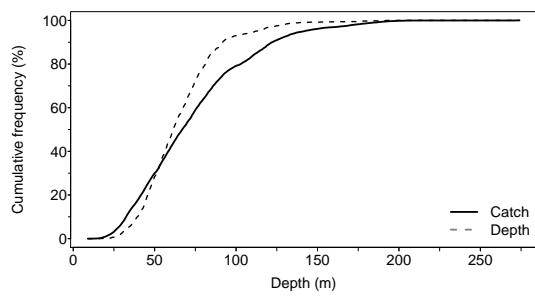
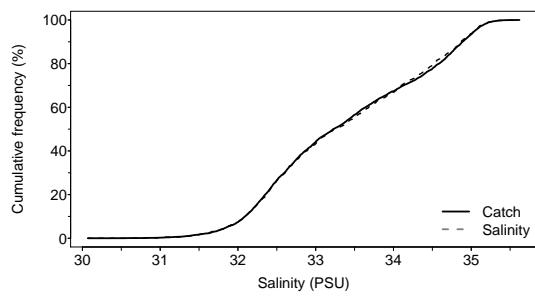


Figure 7.13D. Average fish condition in NAFO units 4X and 4VW for Atlantic wolffish.



829



Freq	Depth	Temp	Sal
F5	34	1.4	31.00
F25	49	3.6	32.48
F50	62	6.0	33.25
F75	77	8.1	34.33
F95	112	10.0	35.05

Figure 7.13E. Catch distribution by depth, temperature and salinity of Atlantic wolffish.

830

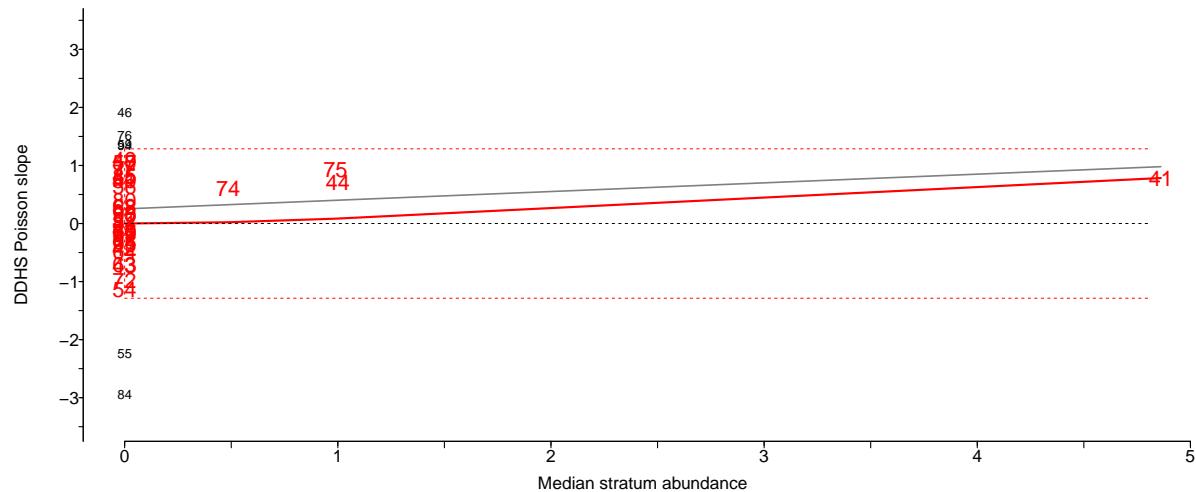


Figure 7.13F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Atlantic wolffish.

831

## 7.14 Atlantic herring (Hareng de l'Atlantique) - species code 60 (category LF)

832

Scientific name: [Clupea harengus](#)

833

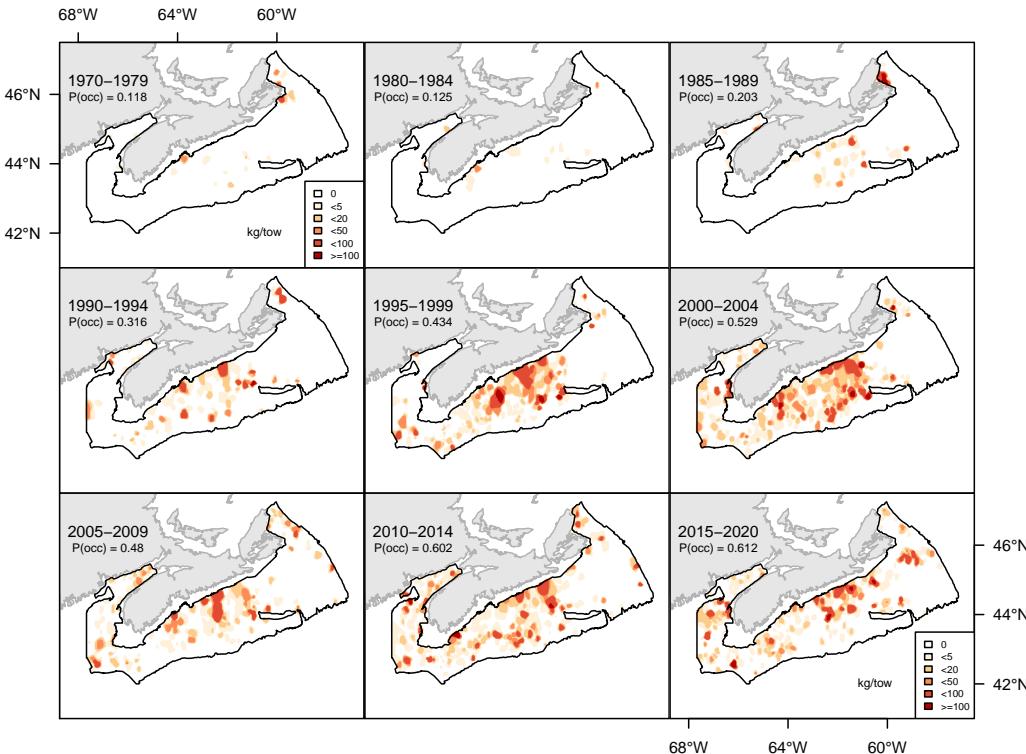


Figure 7.14A. Inverse distance weighted distribution of catch biomass (kg/tow) for Atlantic herring.

834

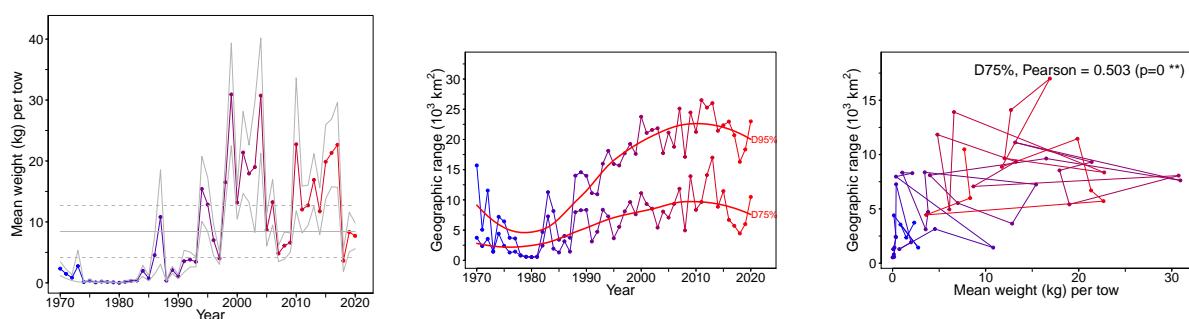


Figure 7.14B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Atlantic herring.

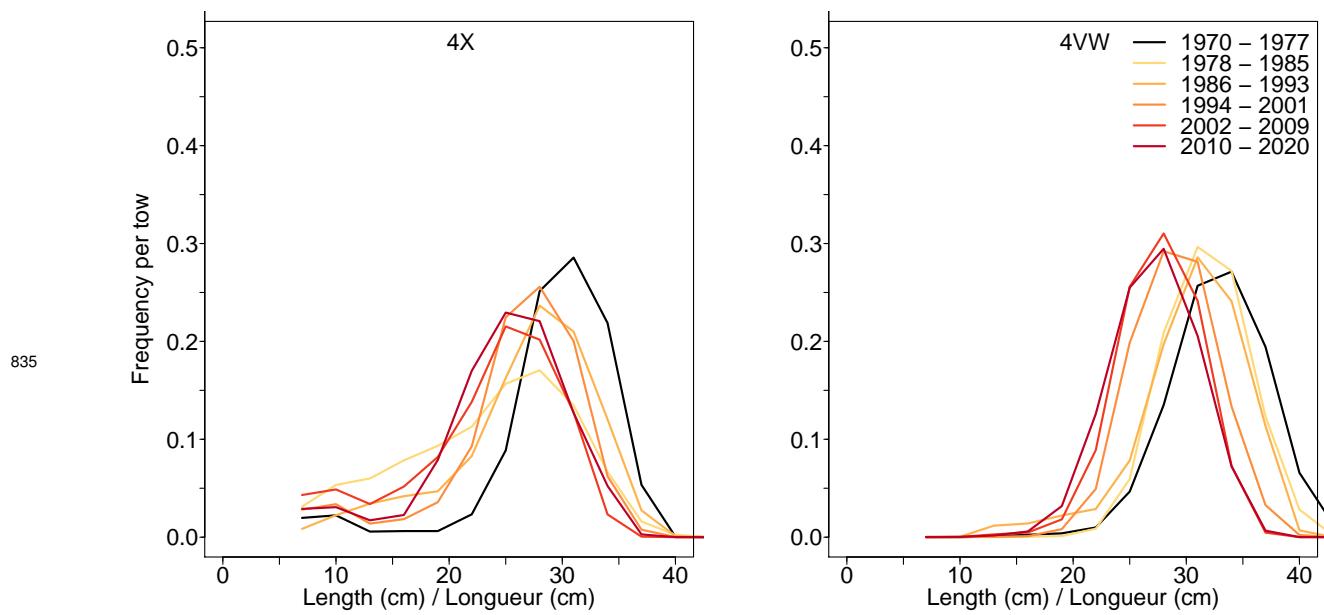


Figure 7.14C. Length frequency distribution in NAFO units 4X and 4VW for Atlantic herring.

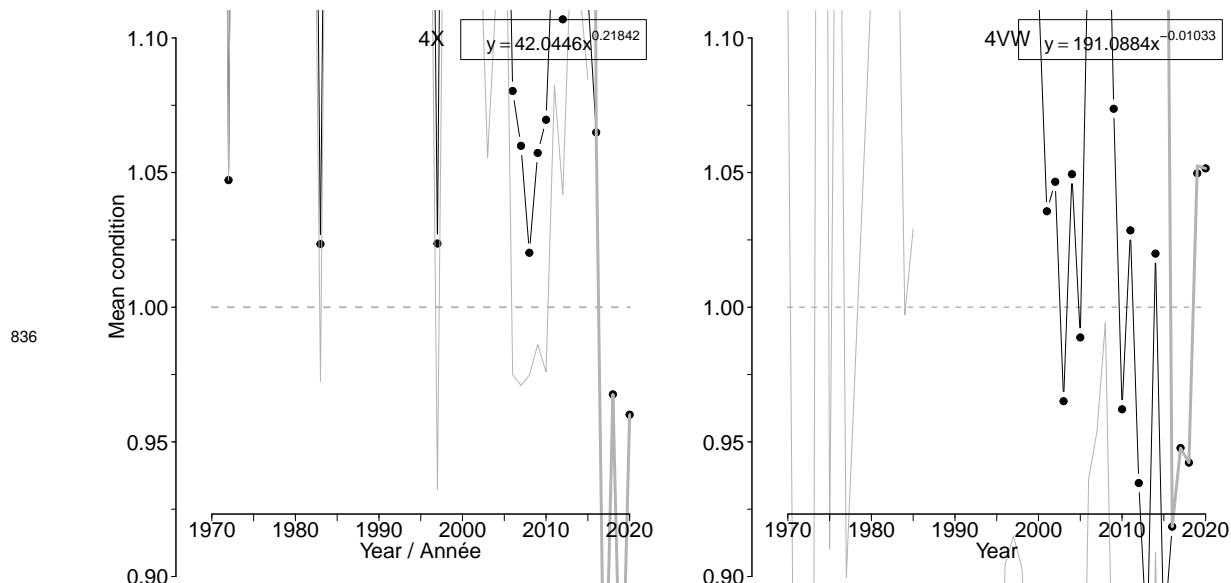
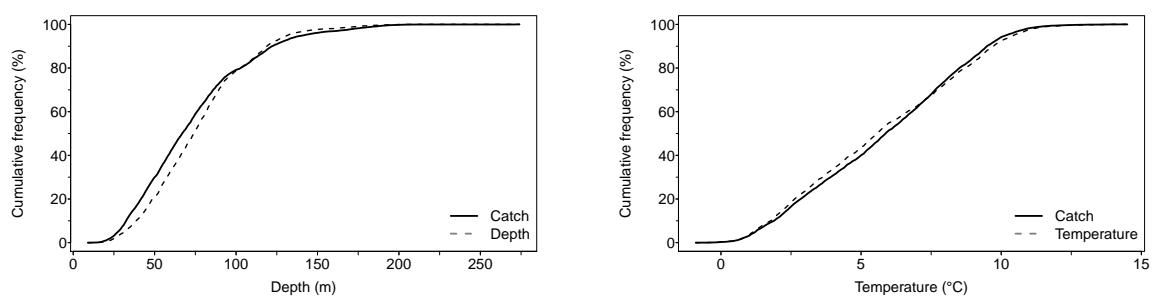
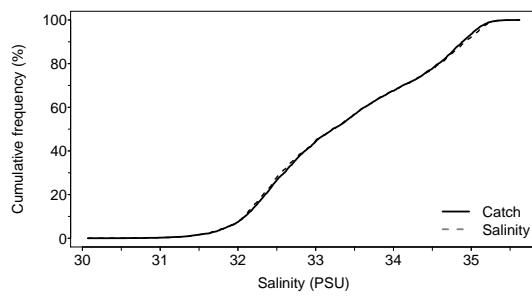


Figure 7.14D. Average fish condition in NAFO units 4X and 4VW for Atlantic herring.



837



Freq	Depth	Temp	Sal
F5	32	1.2	31.00
F25	54	3.2	32.45
F50	74	5.6	33.22
F75	95	8.3	34.38
F95	132	10.0	35.10

Figure 7.14E. Catch distribution by depth, temperature and salinity of Atlantic herring.

838

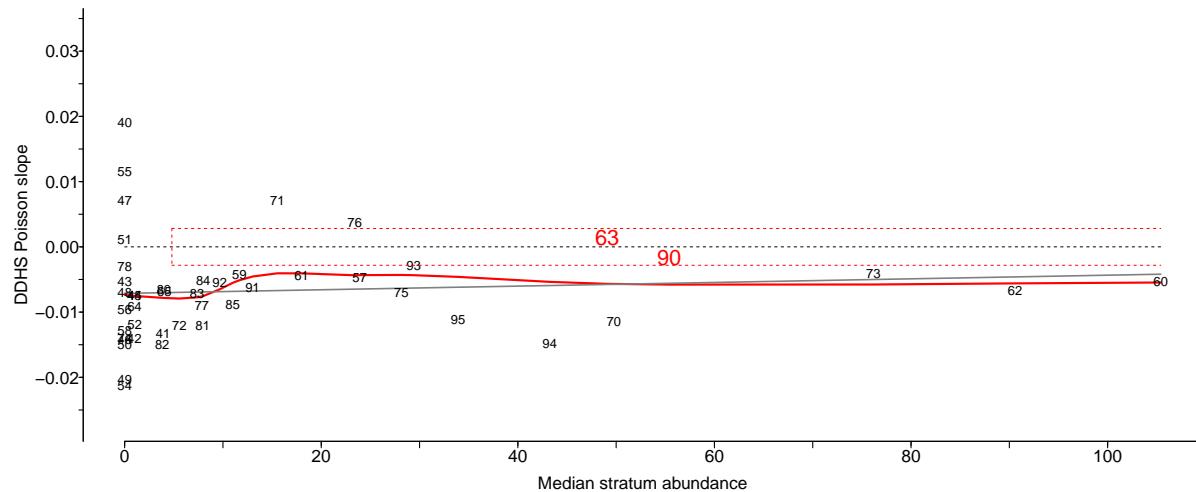


Figure 7.14F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Atlantic herring.

839      **7.15 Longhorn sculpin (Chaboisseau à dix-huit épines) - species code 300 (category**  
 840      **LF)**

841      Scientific name: [Myoxocephalus octodecemspiniferus](#)

842

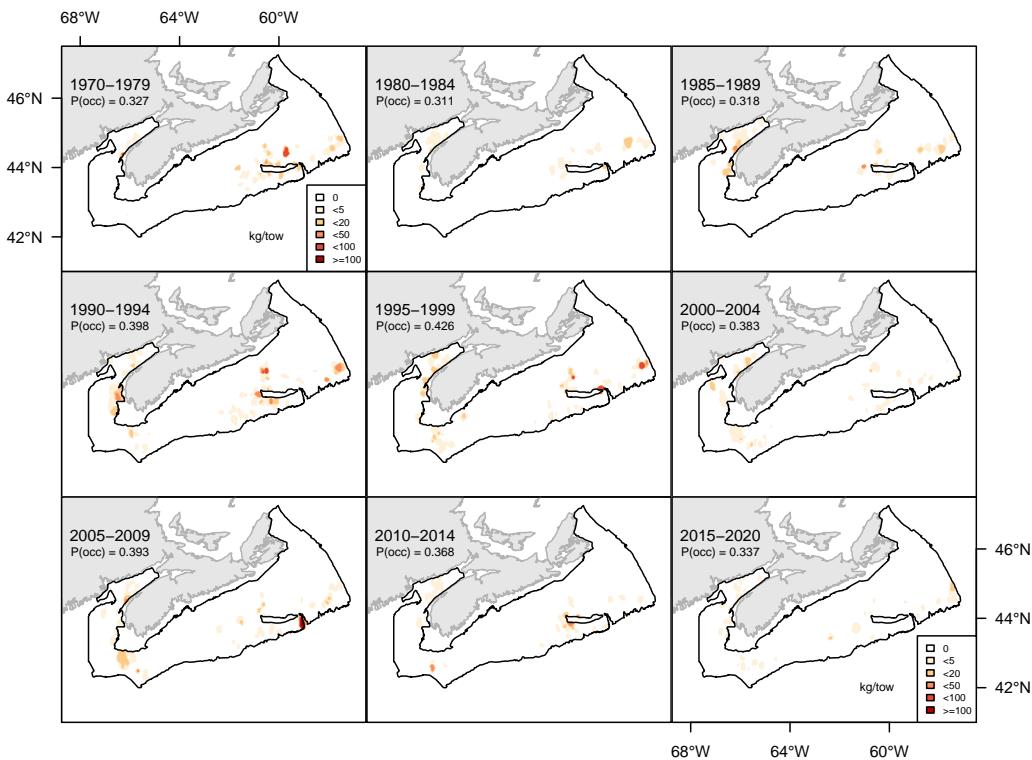


Figure 7.15A. Inverse distance weighted distribution of catch biomass (kg/tow) for Longhorn sculpin.

843

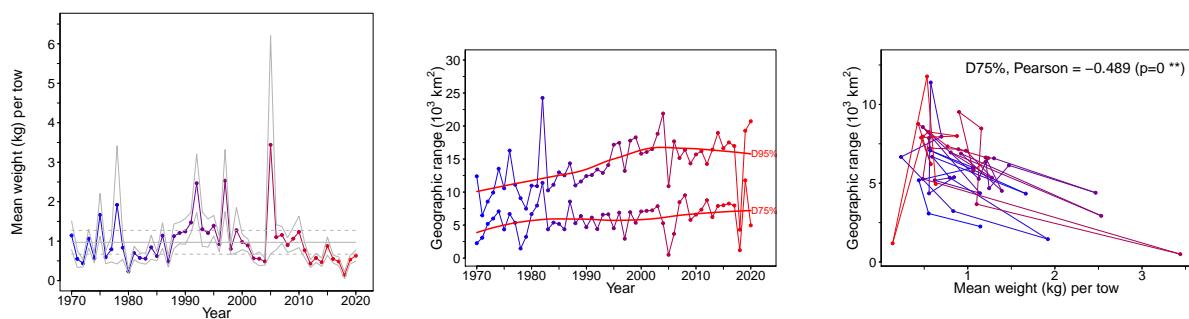


Figure 7.15B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Longhorn sculpin.

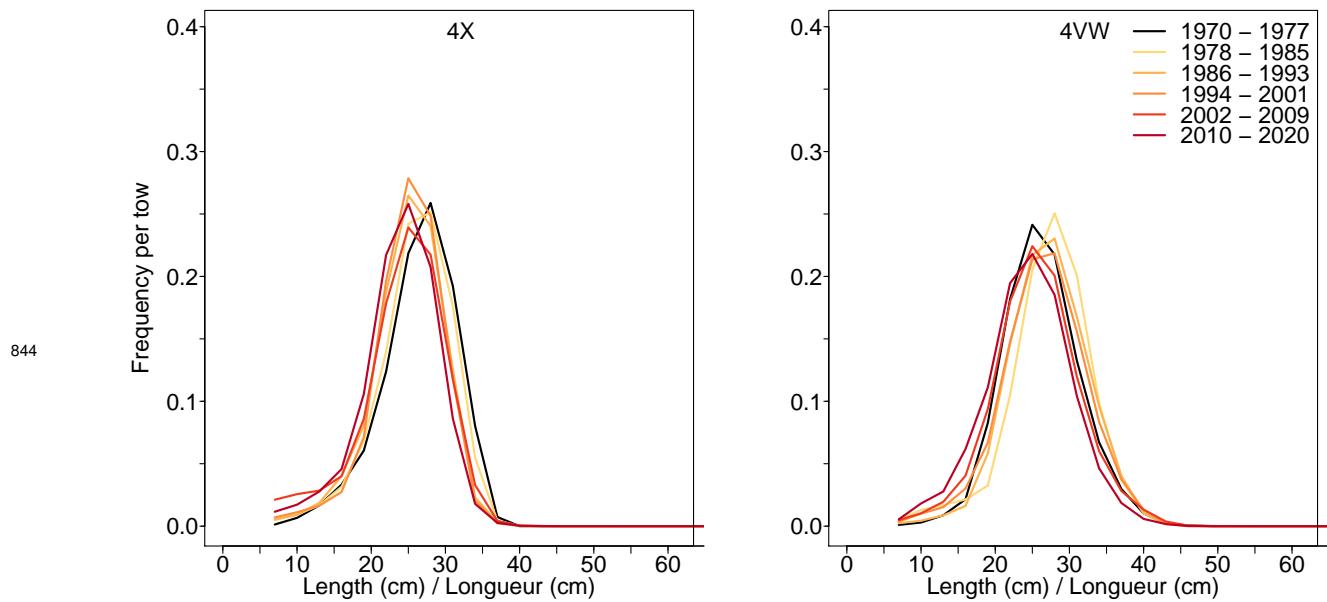


Figure 7.15C. Length frequency distribution in NAFO units 4X and 4VW for Longhorn sculpin.

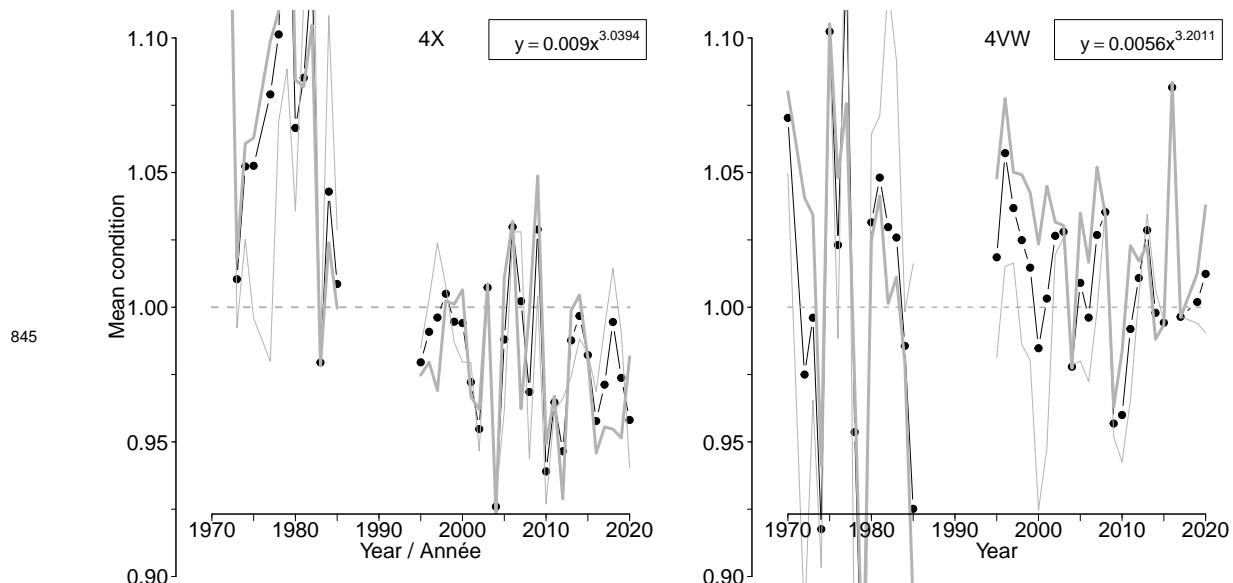
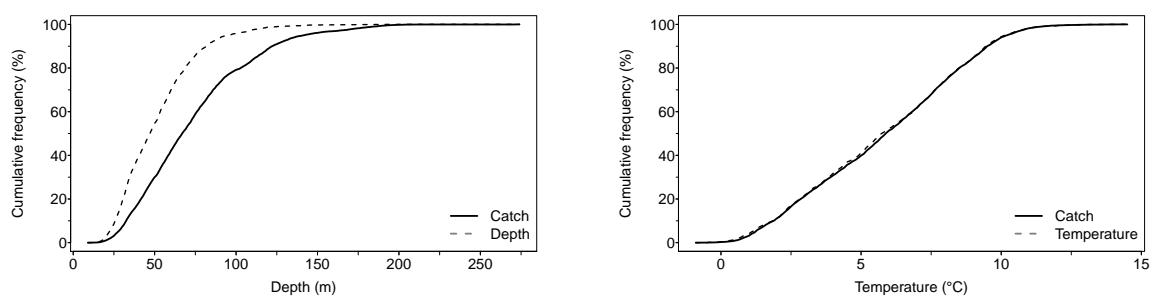
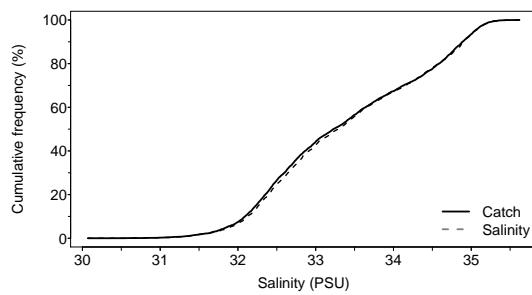


Figure 7.15D. Average fish condition in NAFO units 4X and 4VW for Longhorn sculpin.



846



Freq	Depth	Temp	Sal
F5	23	1.2	31.00
F25	33	3.3	32.51
F50	48	5.8	33.29
F75	64	8.1	34.38
F95	96	10.0	35.05

Figure 7.15E. Catch distribution by depth, temperature and salinity of Longhorn sculpin.

847

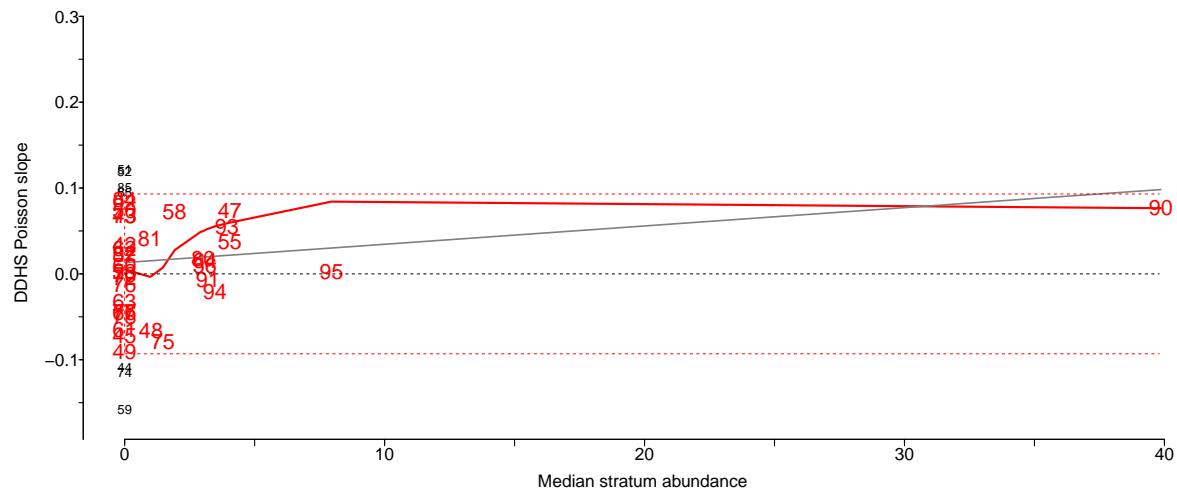


Figure 7.15F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Longhorn sculpin.

848

## 7.16 Moustache sculpin (Faux-trigle armé) - species code 304 (category LF)

849

Scientific name: [Triglops murrayi](#)

850

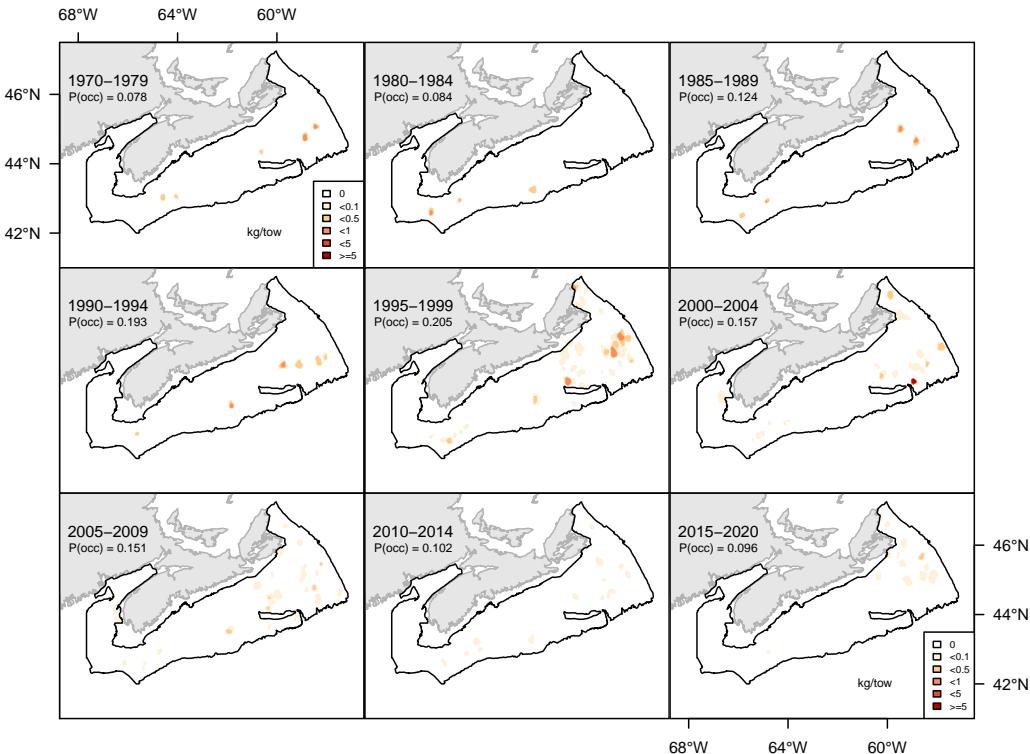


Figure 7.16A. Inverse distance weighted distribution of catch biomass (kg/tow) for Moustache sculpin.

851

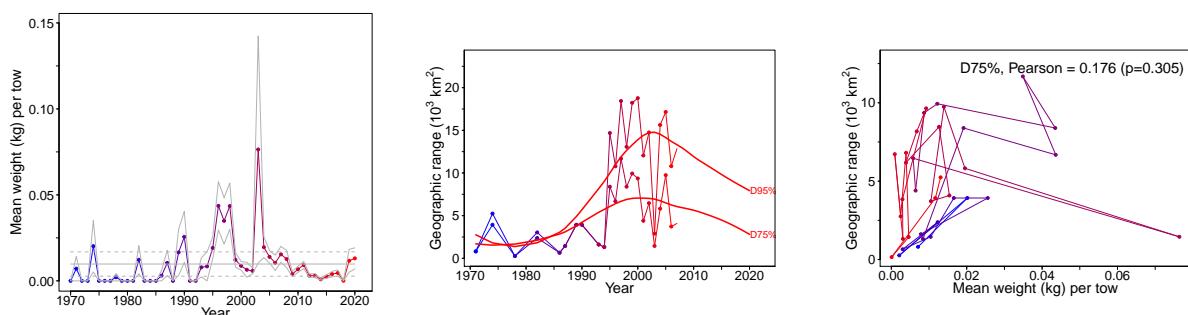


Figure 7.16B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Moustache sculpin.

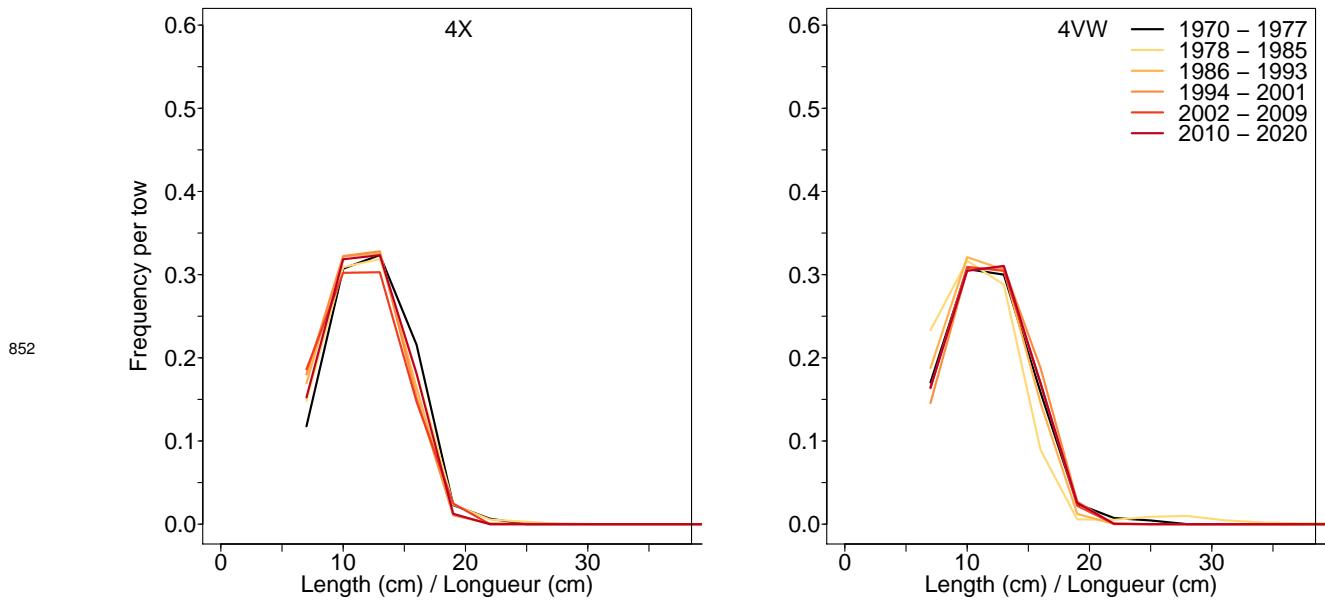


Figure 7.16C. Length frequency distribution in NAFO units 4X and 4VW for Moustache sculpin.

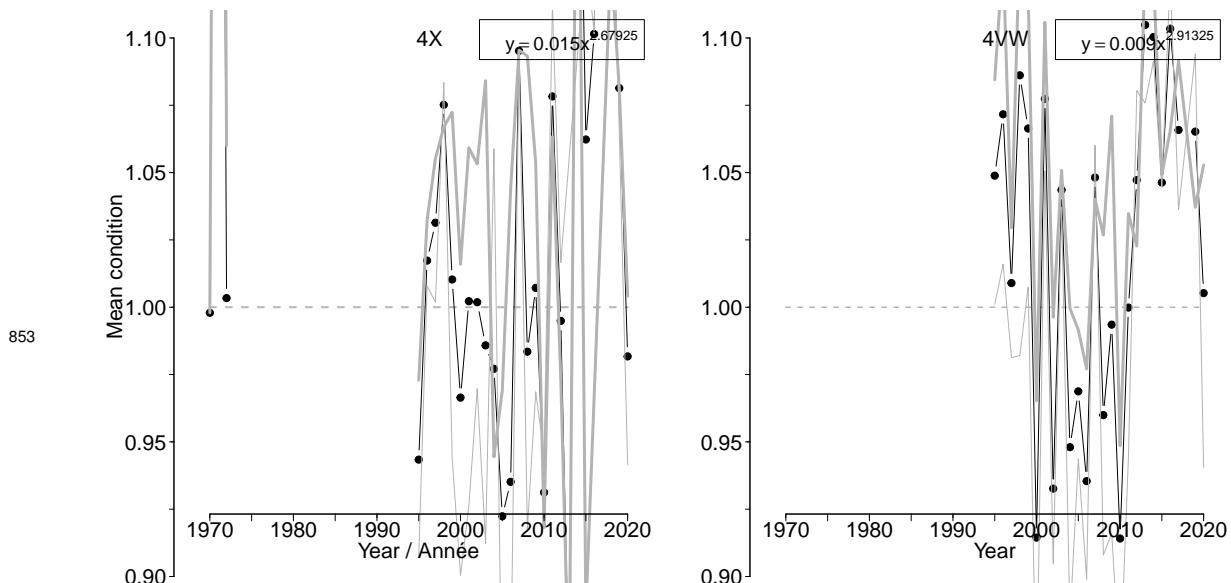
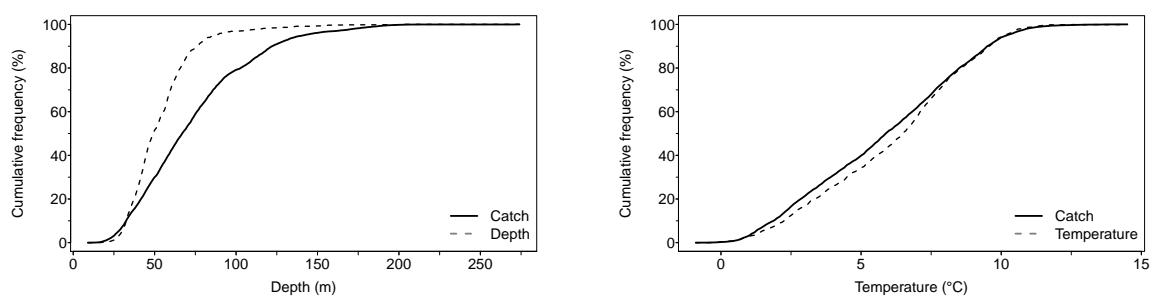
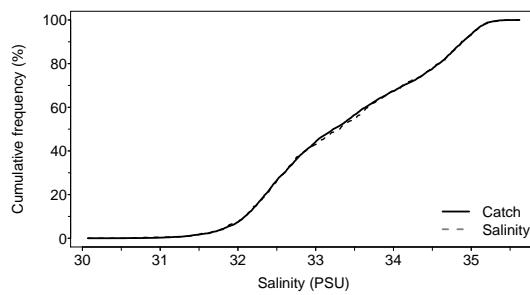


Figure 7.16D. Average fish condition in NAFO units 4X and 4VW for Moustache sculpin.

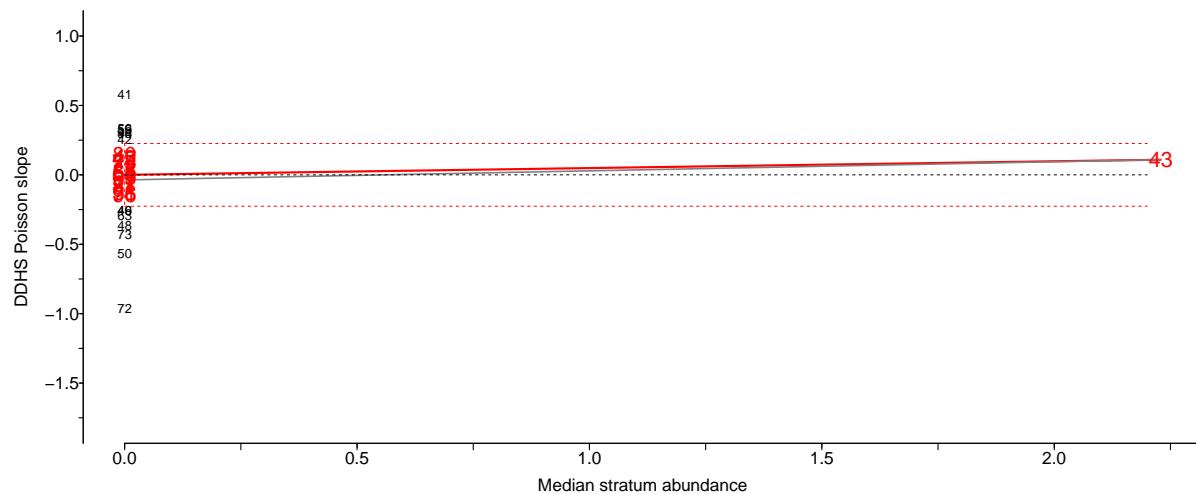


854



Freq	Depth	Temp	Sal
F5	30	1.5	31.00
F25	40	4.0	32.48
F50	50	6.5	33.31
F75	63	8.2	34.39
F95	88	10.0	35.06

Figure 7.16E. Catch distribution by depth, temperature and salinity of Moustache sculpin.



855

Figure 7.16F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Moustache sculpin.

856

## 7.17 Sea raven (Hémithriptère atlantique) - species code 320 (category LF)

857

Scientific name: [Hemitripterus americanus](#)

858

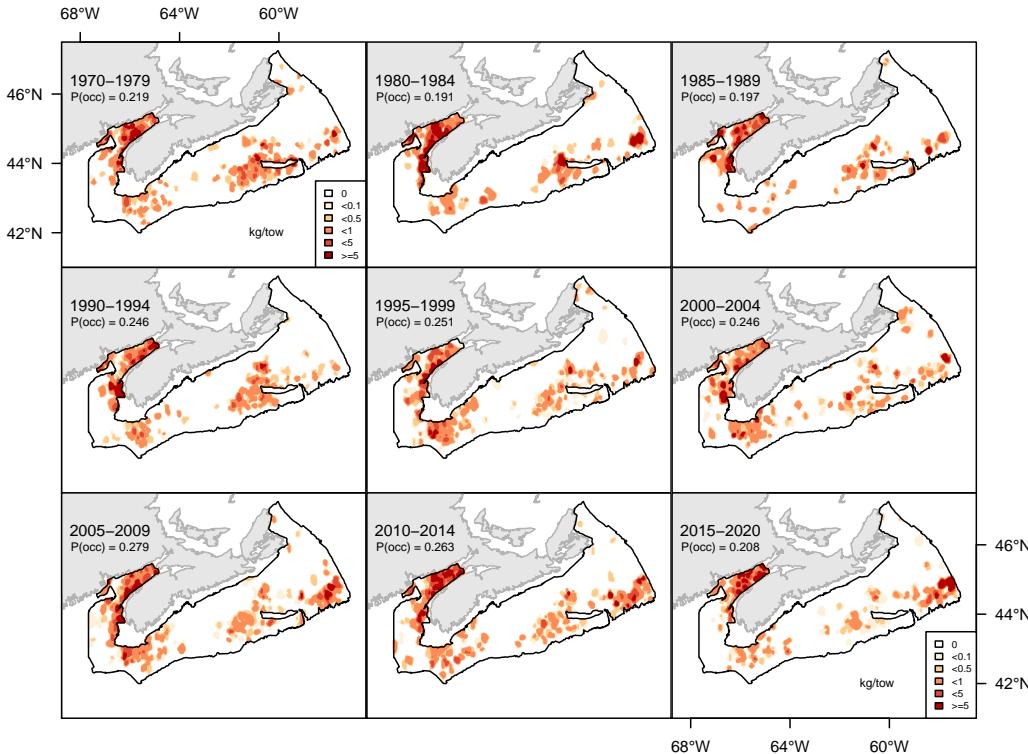


Figure 7.17A. Inverse distance weighted distribution of catch biomass (kg/tow) for Sea raven.

859

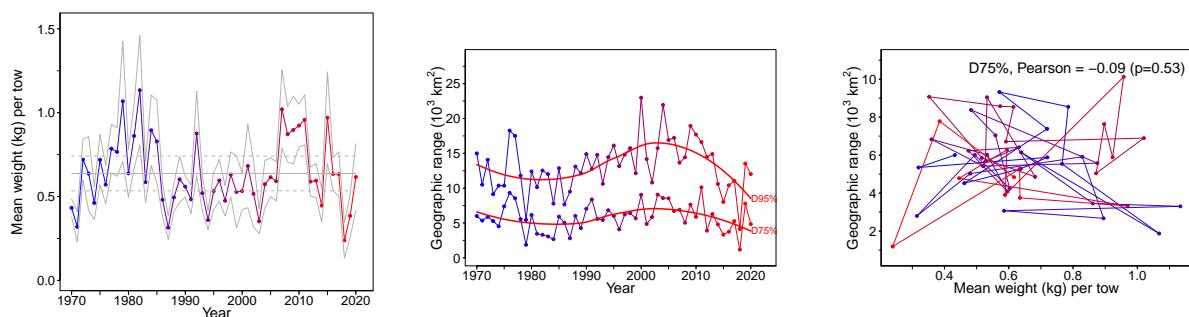


Figure 7.17B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Sea raven.

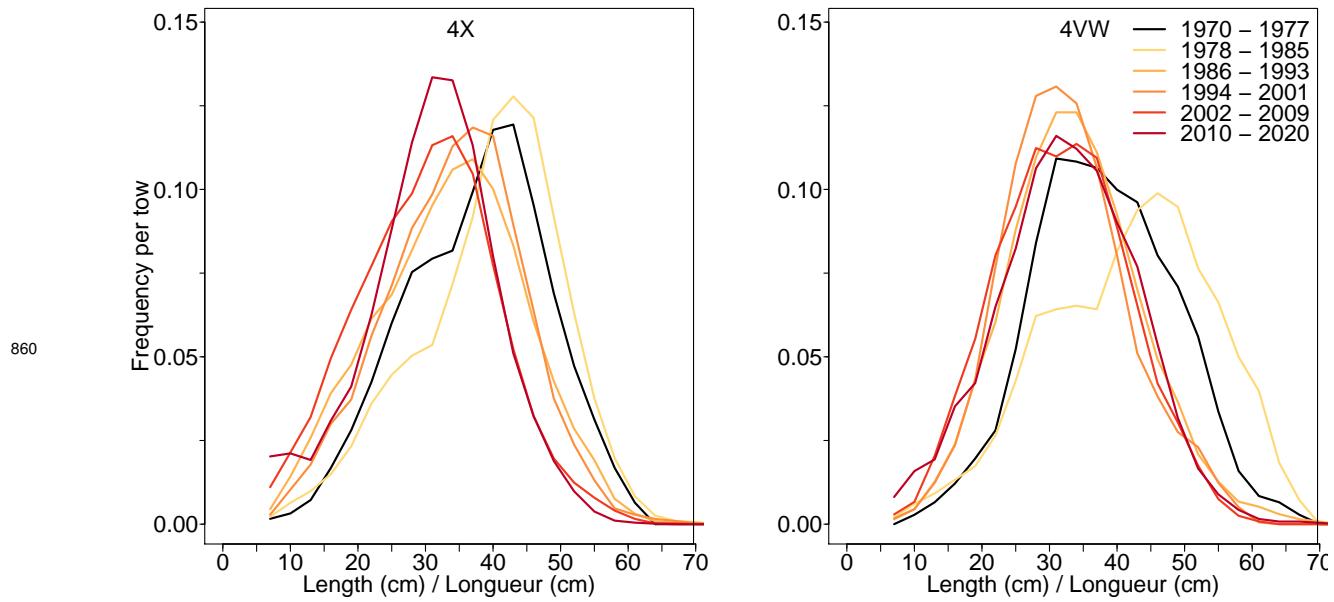


Figure 7.17C. Length frequency distribution in NAFO units 4X and 4VW for Sea raven.

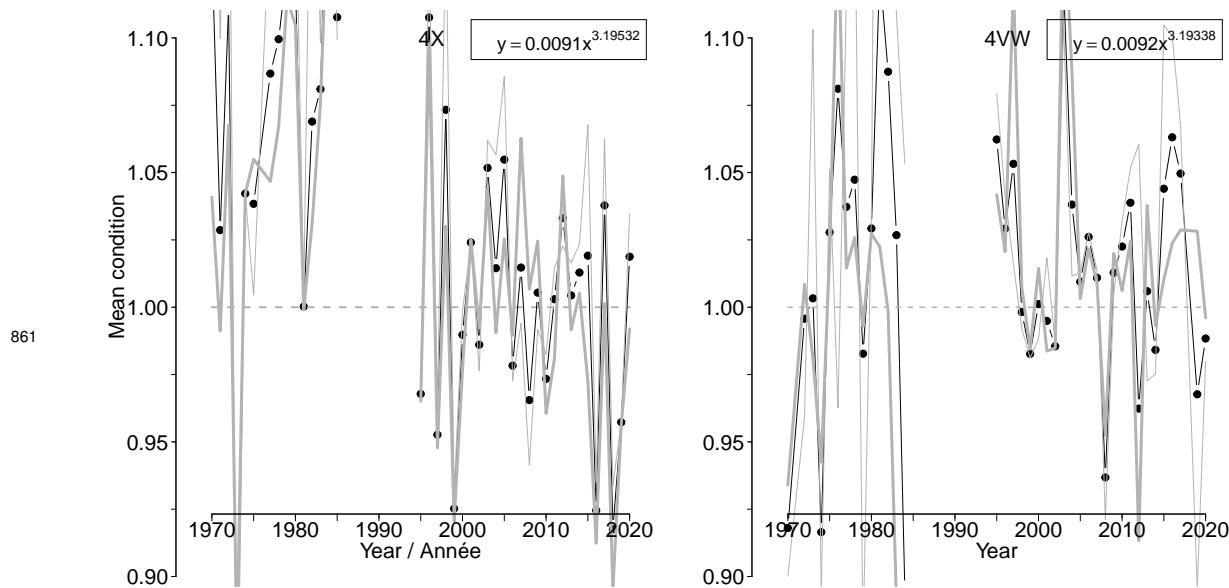
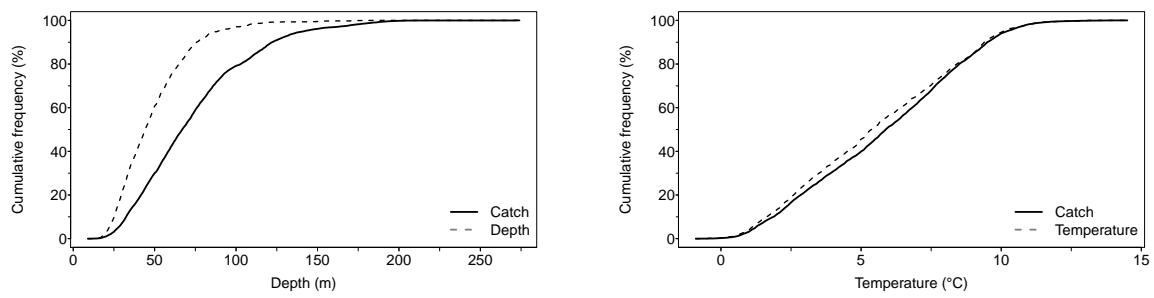
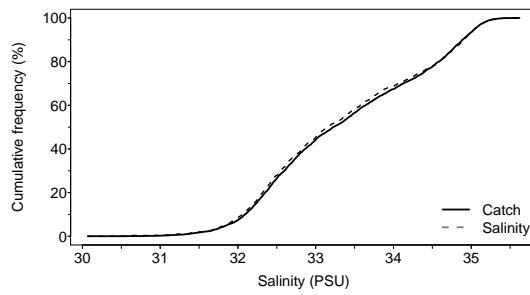


Figure 7.17D. Average fish condition in NAFO units 4X and 4VW for Sea raven.



862



Freq	Depth	Temp	Sal
F5	22	1.1	31.00
F25	32	3.1	32.43
F50	45	5.4	33.15
F75	61	8.0	34.35
F95	89	10.0	35.05

Figure 7.17E. Catch distribution by depth, temperature and salinity of Sea raven.

863

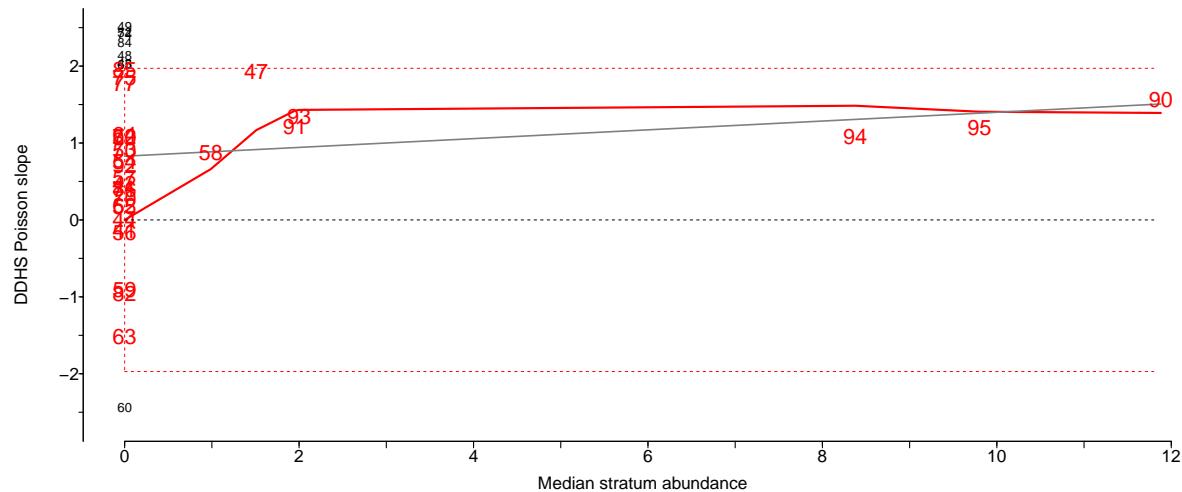


Figure 7.17F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Sea raven.

864      **7.18 Alligatorfish (Poisson-alligator atlantique) - species code 340 (category LF)**

865      Scientific name: [Aspidophoroides monopterygius](#)

866

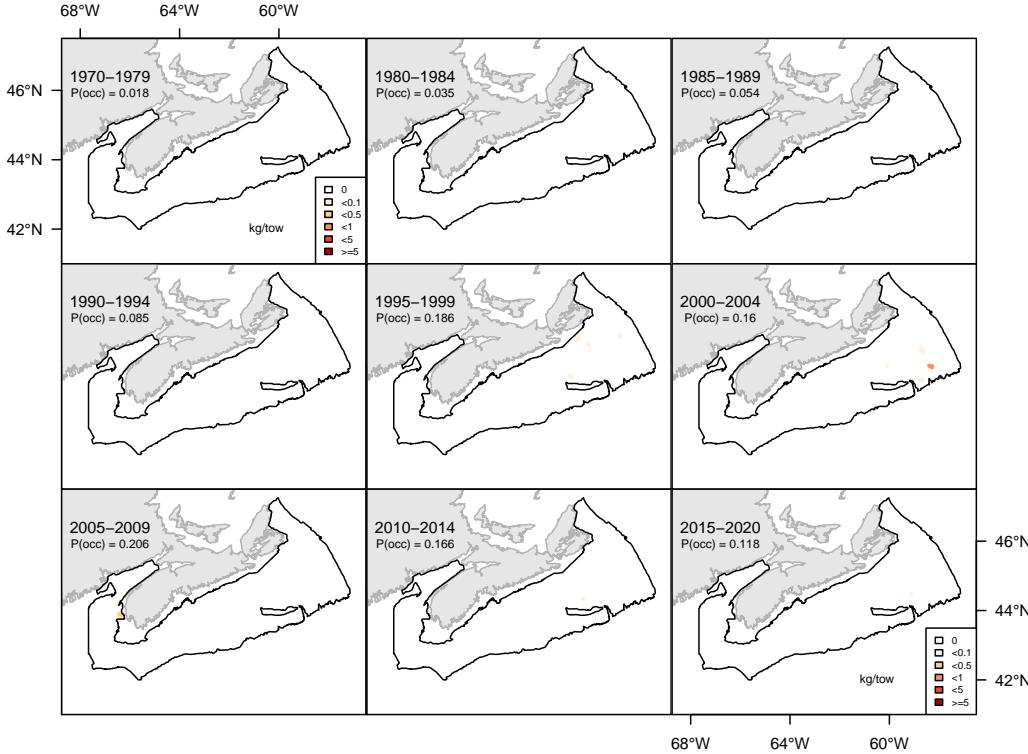


Figure 7.18A. Inverse distance weighted distribution of catch biomass (kg/tow) for Alligatorfish.

867

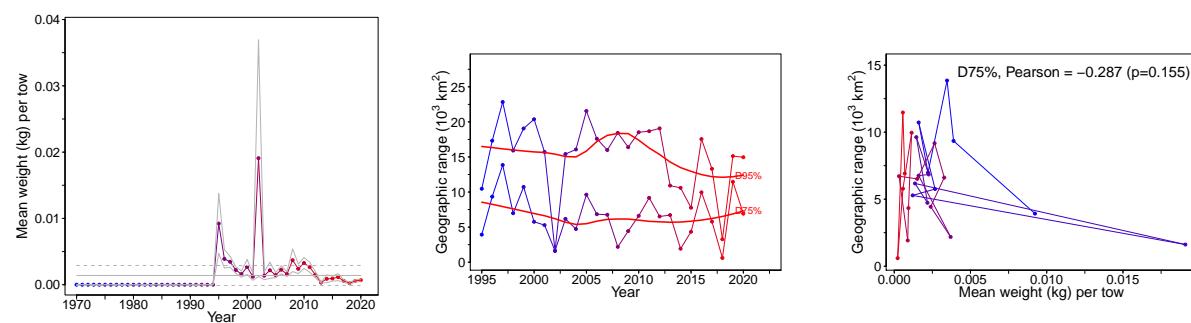


Figure 7.18B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Alligatorfish.

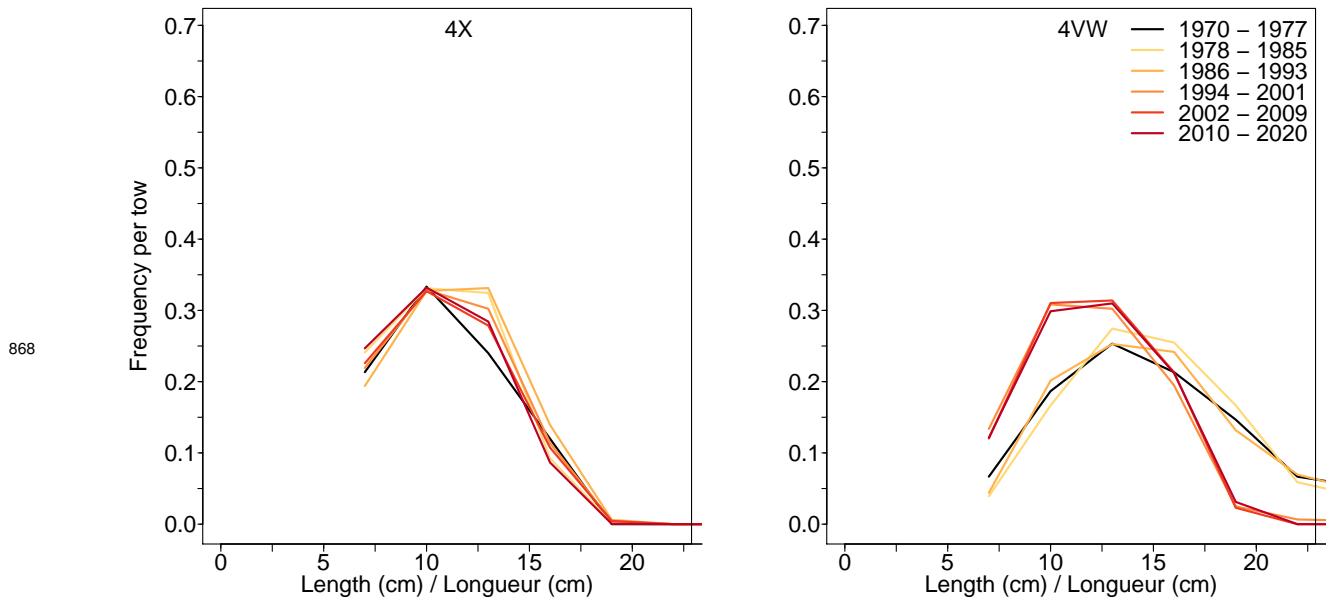


Figure 7.18C. Length frequency distribution in NAFO units 4X and 4VW for Alligatorfish.

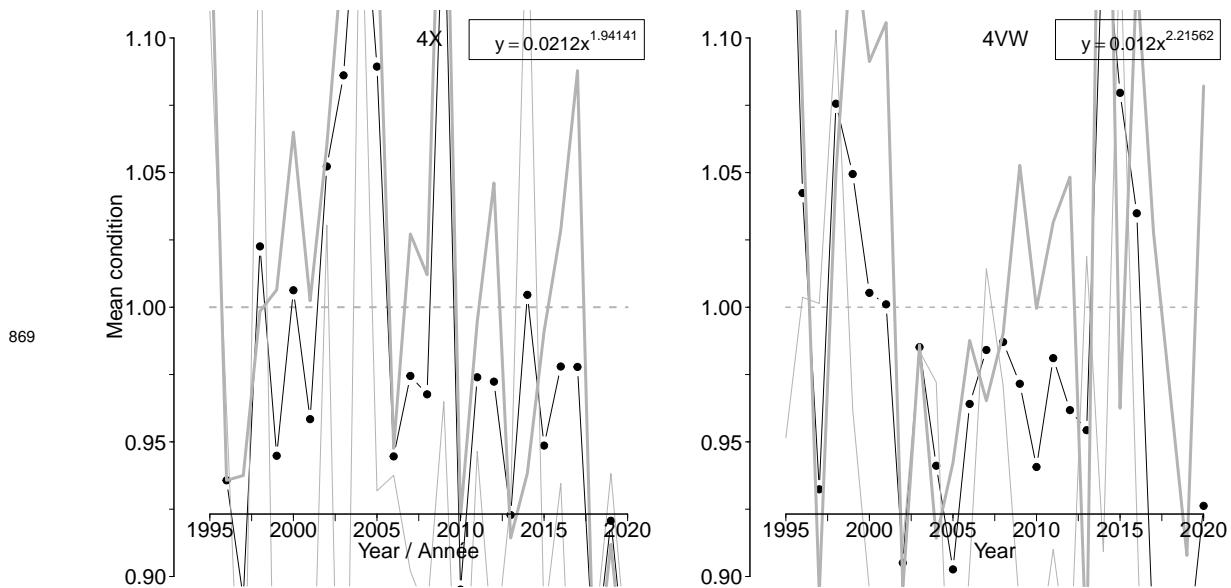
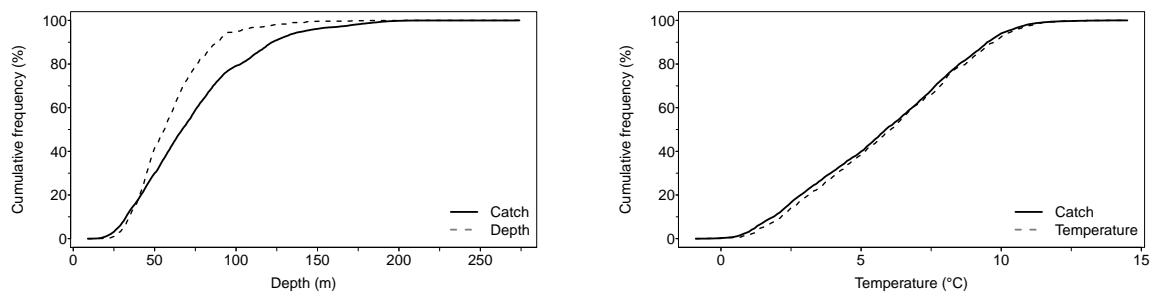
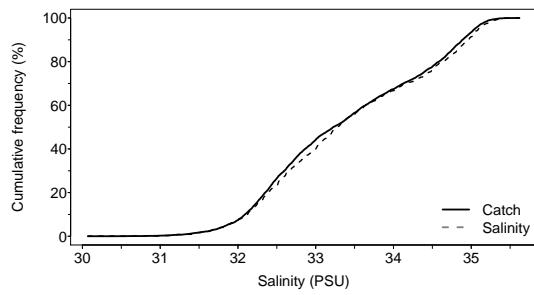


Figure 7.18D. Average fish condition in NAFO units 4X and 4VW for Alligatorfish.



870



Freq	Depth	Temp	Sal
F5	32	1.5	31.00
F25	44	3.7	32.53
F50	57	6.1	33.28
F75	72	8.2	34.45
F95	102	10.0	35.10

Figure 7.18E. Catch distribution by depth, temperature and salinity of Alligatorfish.

871

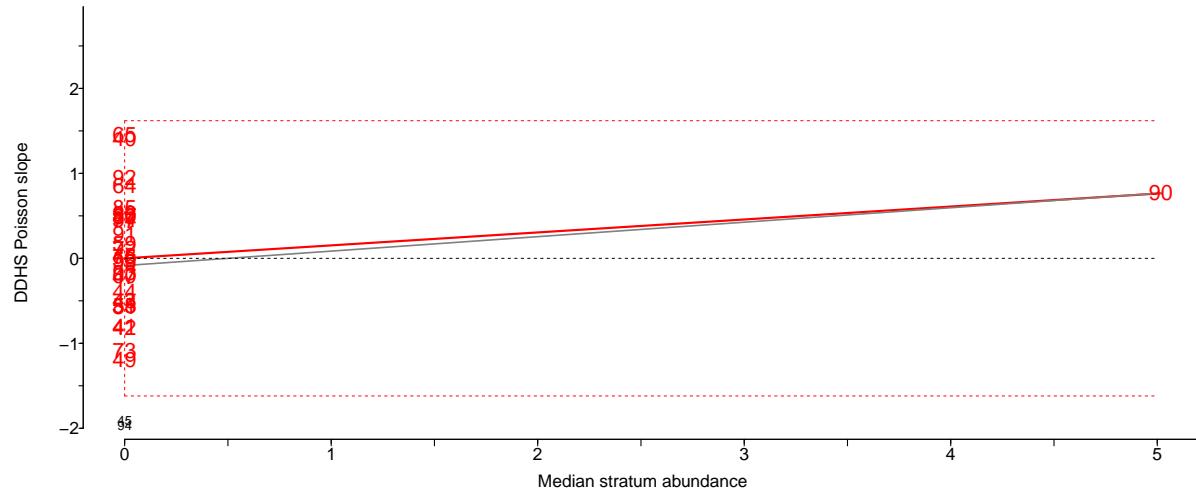


Figure 7.18F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Alligatorfish.

872

## 7.19 Monkfish (Baudroie d'Amérique) - species code 400 (category LF)

873

Scientific name: [Lophius americanus](#)

874

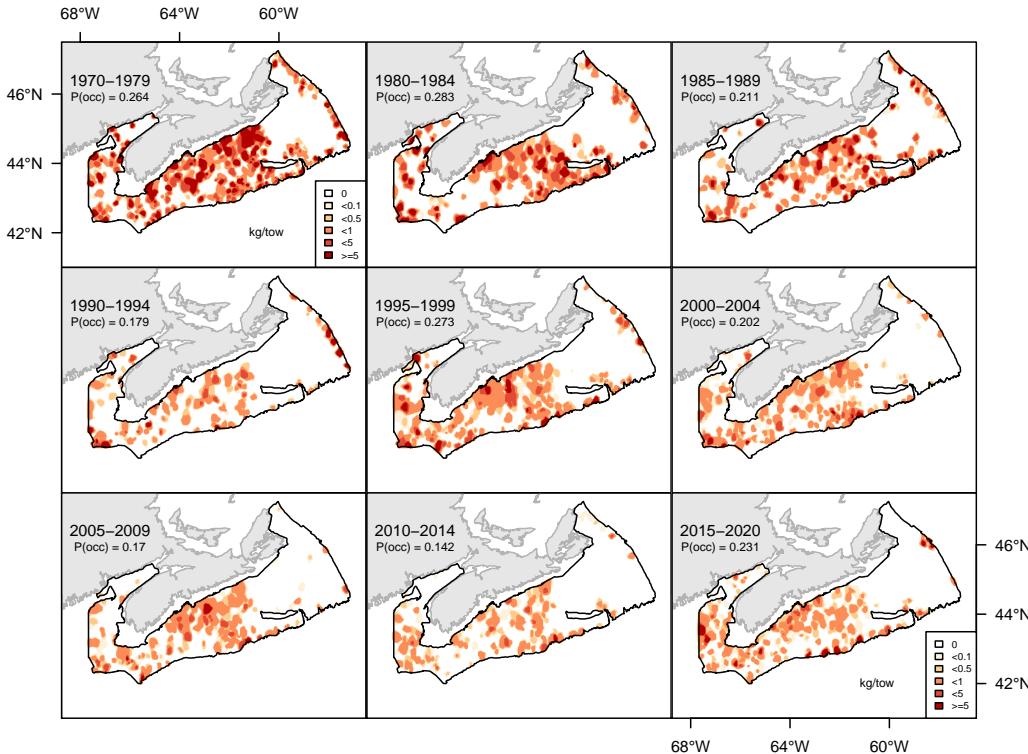


Figure 7.19A. Inverse distance weighted distribution of catch biomass (kg/tow) for Monkfish.

875

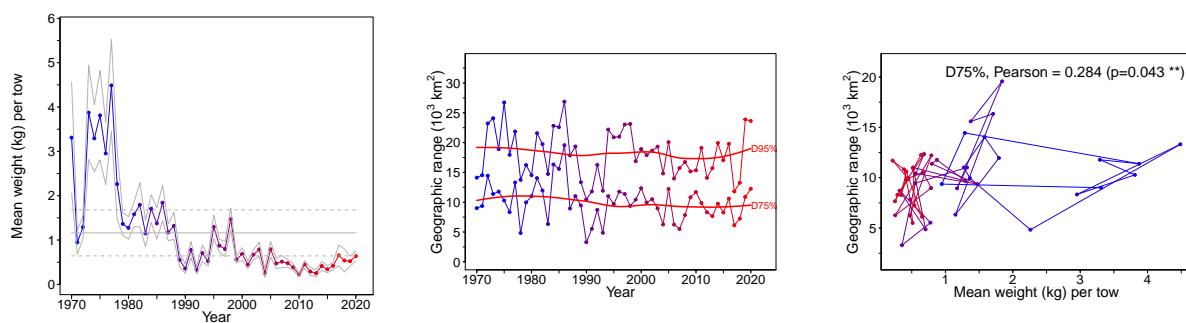


Figure 7.19B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Monkfish.

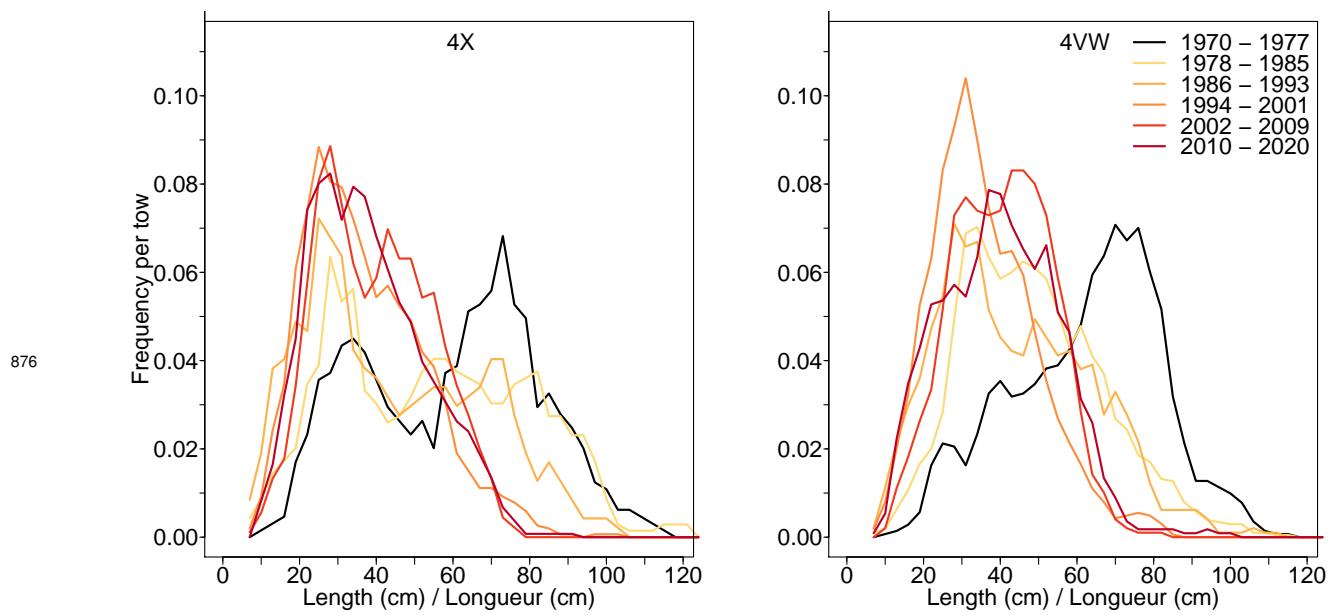


Figure 7.19C. Length frequency distribution in NAFO units 4X and 4VW for Monkfish.

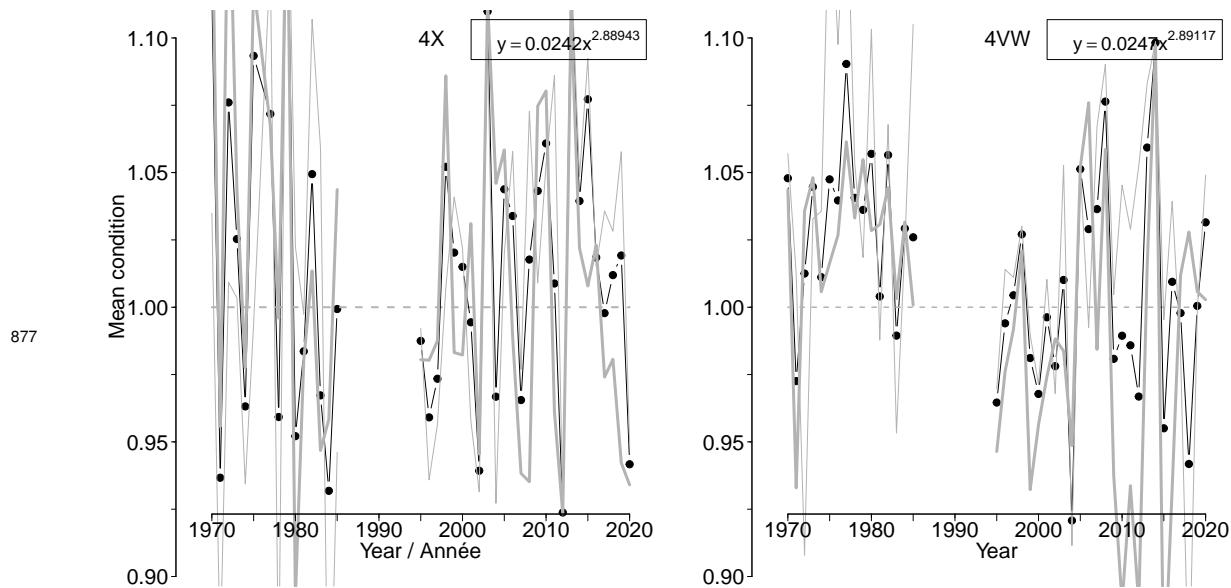
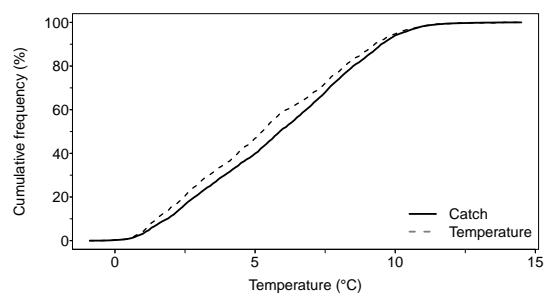
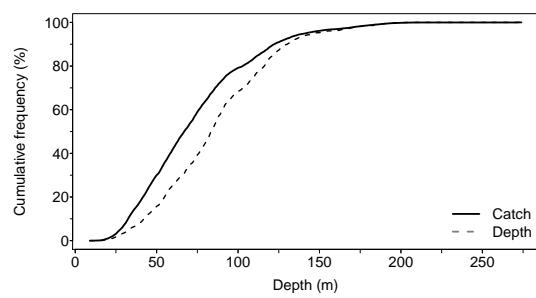
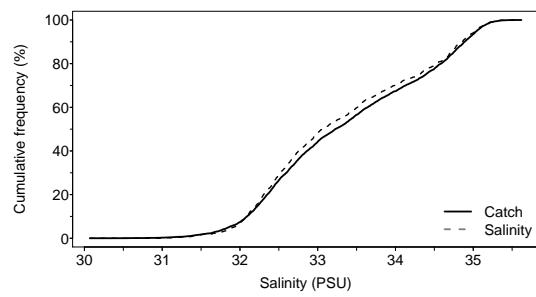


Figure 7.19D. Average fish condition in NAFO units 4X and 4VW for Monkfish.

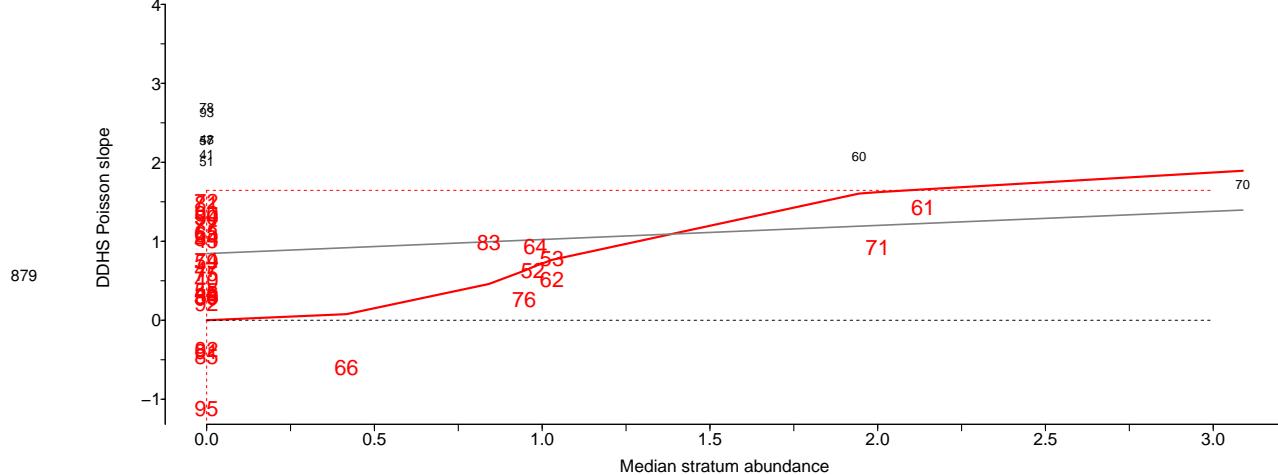


878



Freq	Depth	Temp	Sal
F5	33	1.1	31.00
F25	60	2.9	32.43
F50	84	5.3	33.07
F75	110	7.8	34.31
F95	148	10.0	35.03

Figure 7.19E. Catch distribution by depth, temperature and salinity of Monkfish.



879

Figure 7.19F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Monkfish.

880      **7.20 Ocean pout (Loquette d'Amérique) - species code 640 (category LF)**

881      Scientific name: *Zoarces americanus*

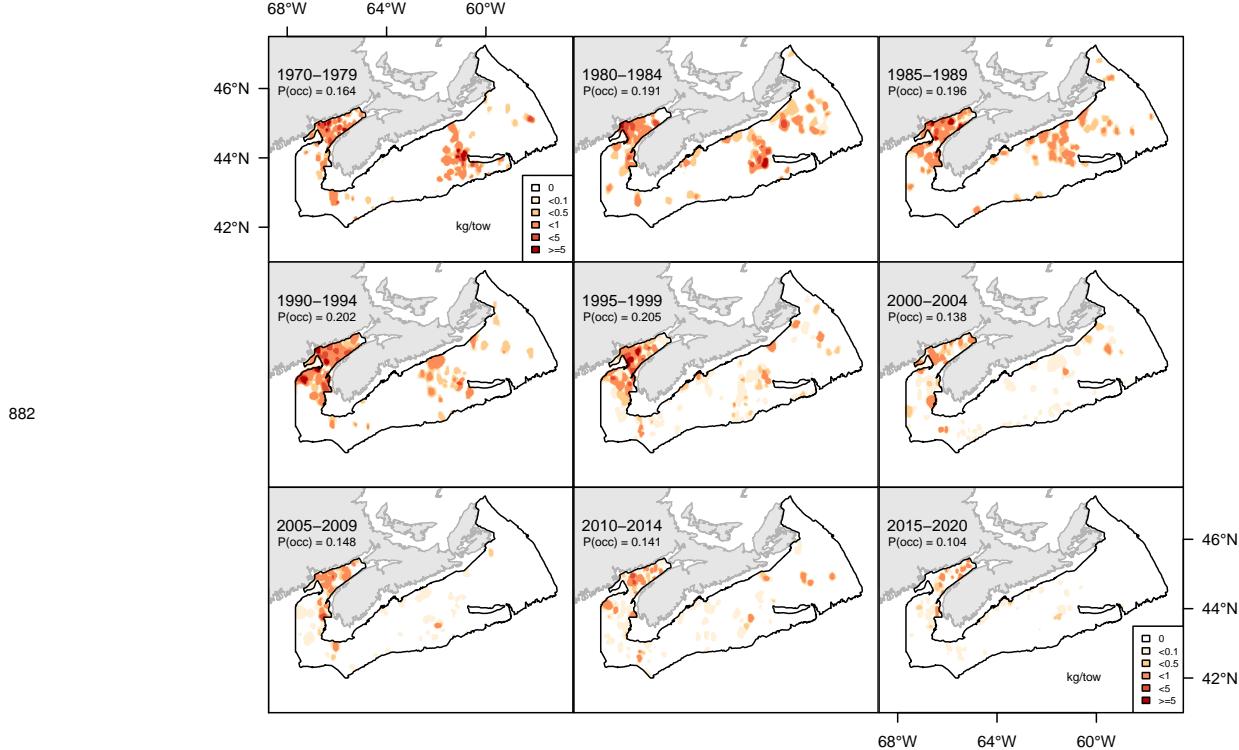


Figure 7.20A. Inverse distance weighted distribution of catch biomass (kg/tow) for Ocean pout.

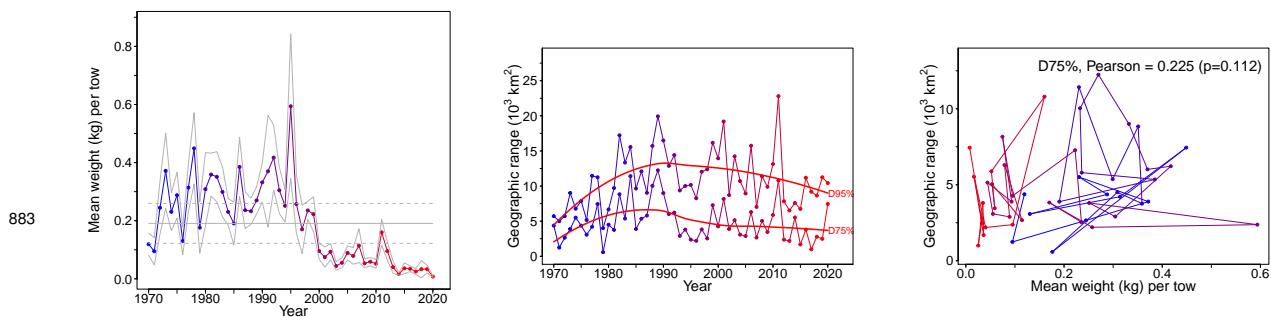


Figure 7.20B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Ocean pout.

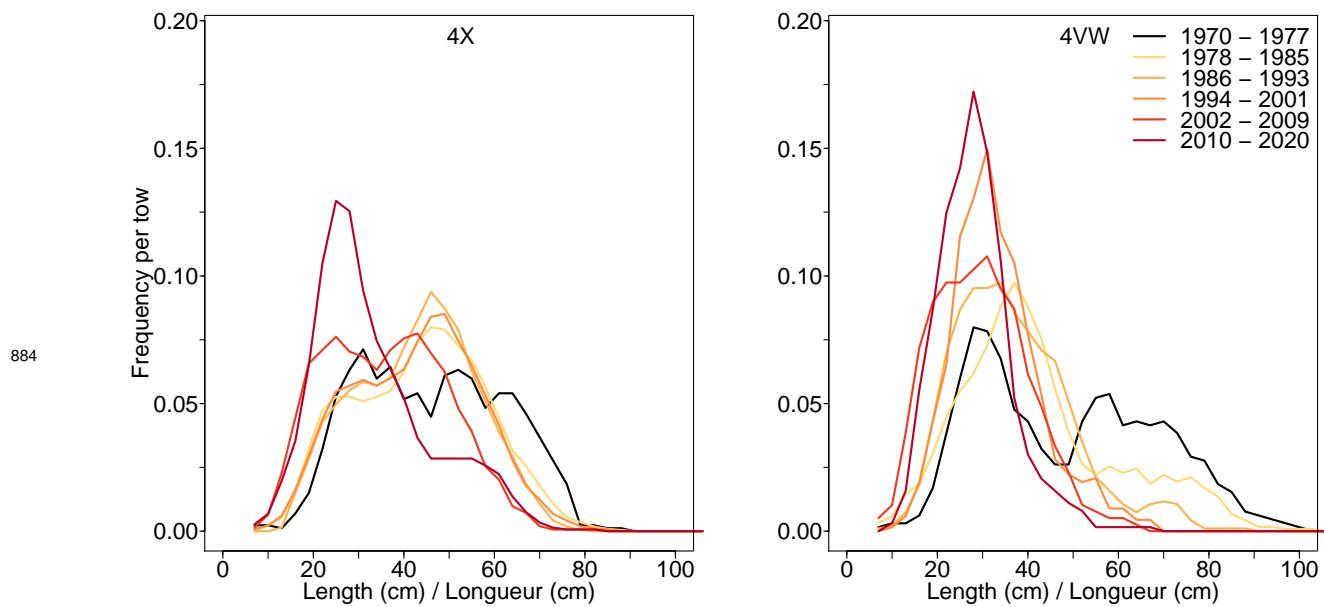


Figure 7.20C. Length frequency distribution in NAFO units 4X and 4VW for Ocean pout.

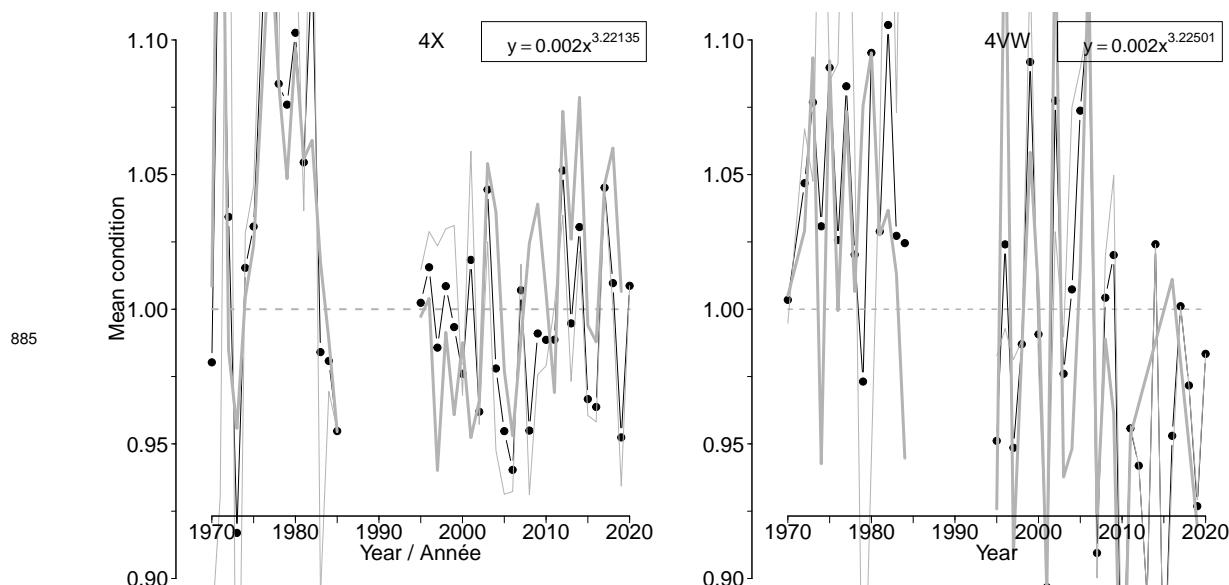
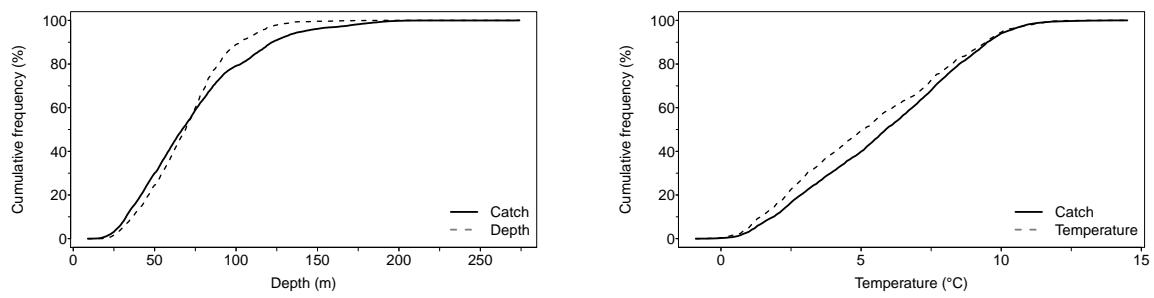
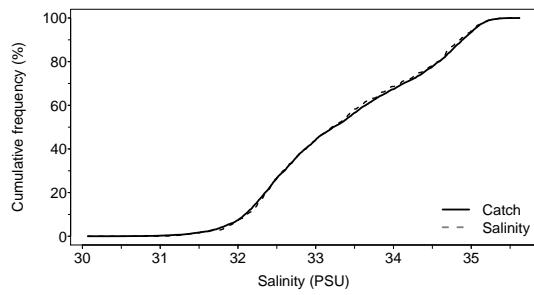


Figure 7.20D. Average fish condition in NAFO units 4X and 4VW for Ocean pout.



886



Freq	Depth	Temp	Sal
F5	31	1.0	31.00
F25	52	2.8	32.46
F50	69	5.1	33.22
F75	85	7.7	34.34
F95	116	10.0	35.03

Figure 7.20E. Catch distribution by depth, temperature and salinity of Ocean pout.

887

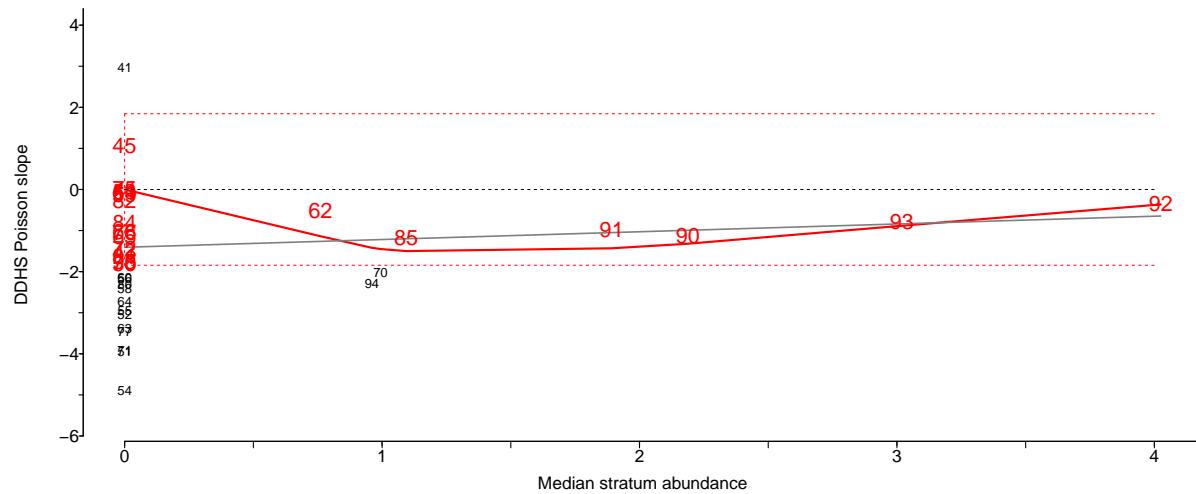


Figure 7.20F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Ocean pout.

888

## 7.21 Thorny skate (Raie épineuse) - species code 201 (category LF)

889

Scientific name: [Amblyraja radiata](#)

890

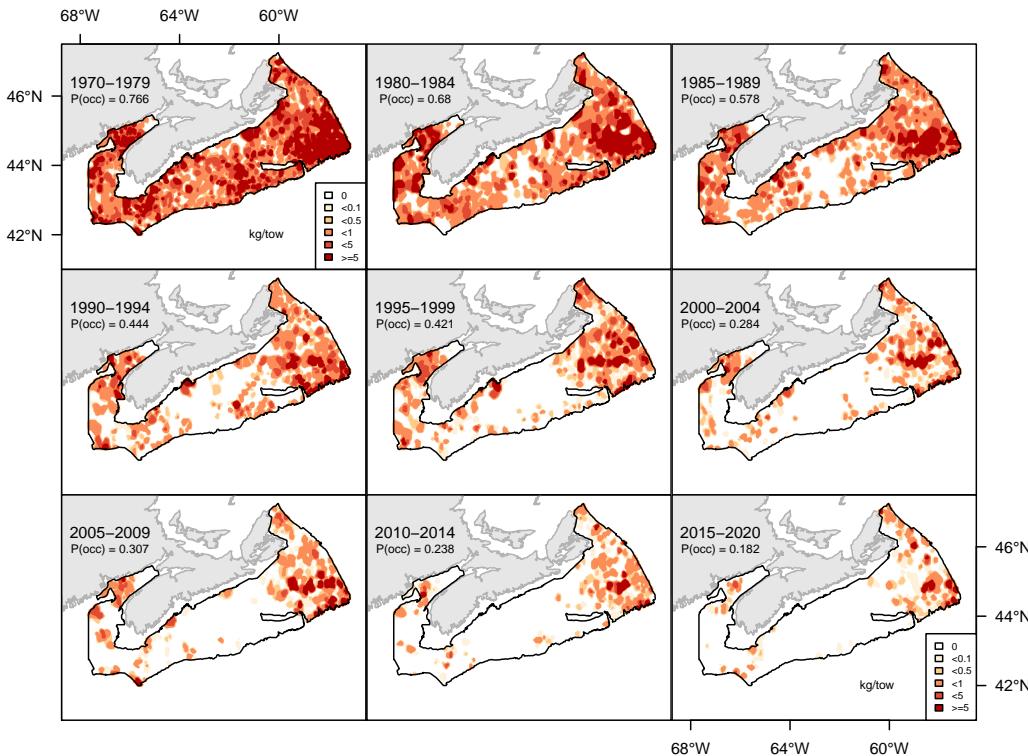


Figure 7.21A. Inverse distance weighted distribution of catch biomass (kg/tow) for Thorny skate.

891

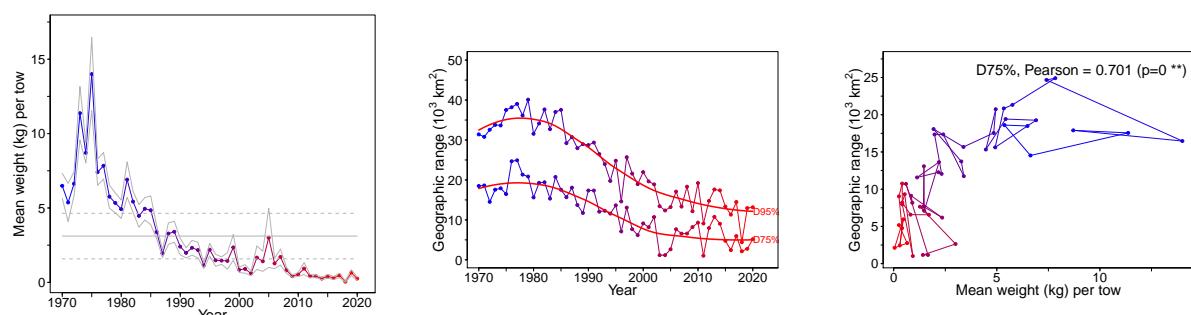


Figure 7.21B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Thorny skate.

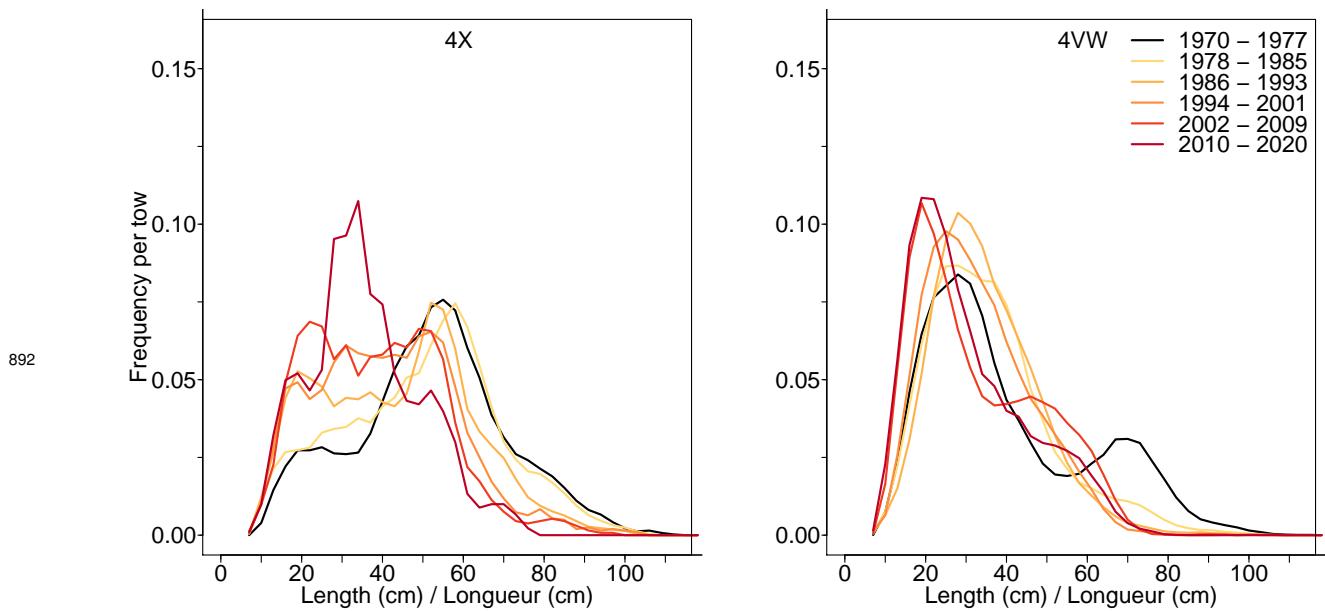


Figure 7.21C. Length frequency distribution in NAFO units 4X and 4VW for Thorny skate.

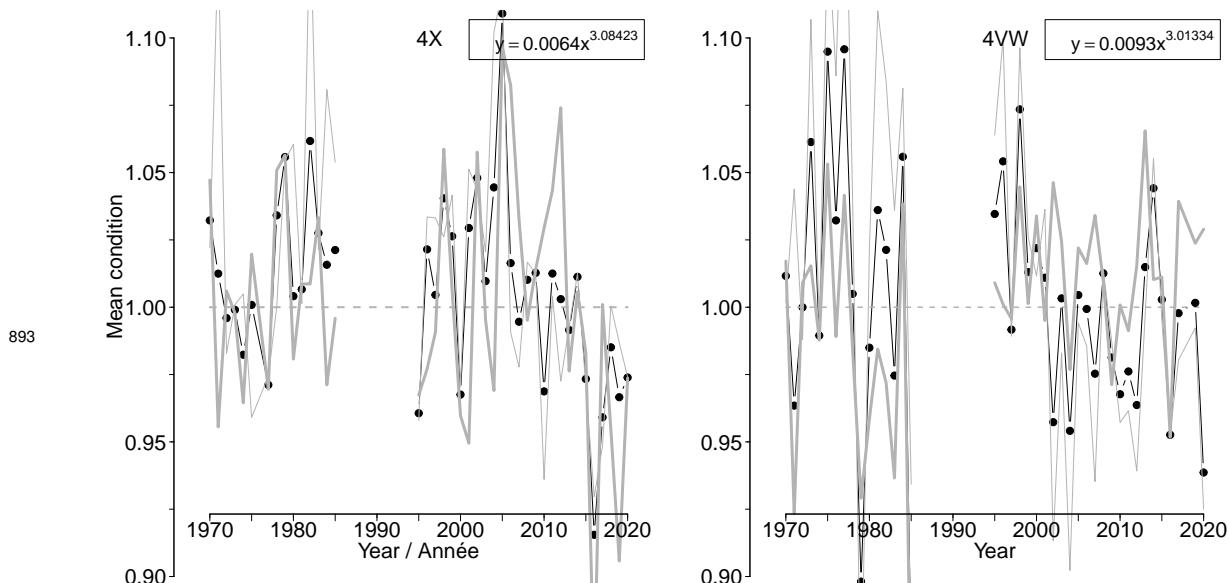
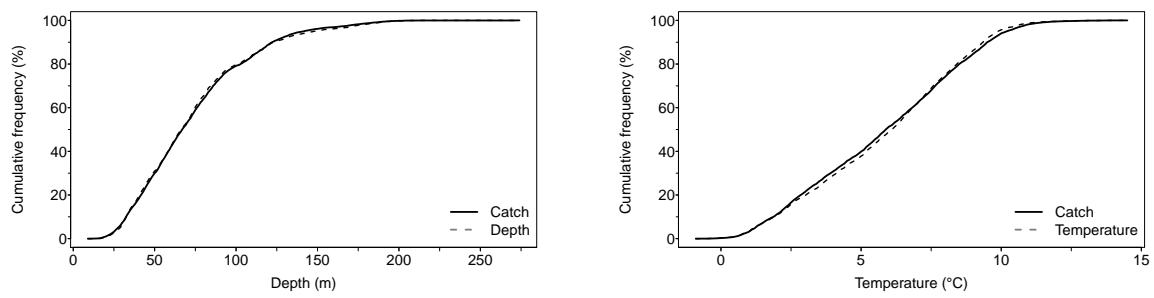
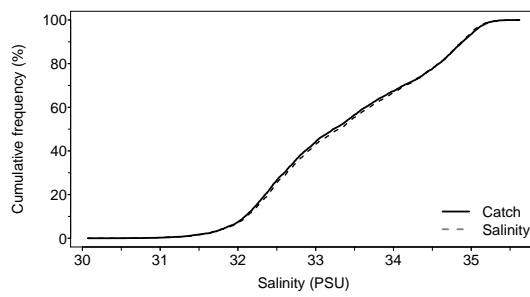


Figure 7.21D. Average fish condition in NAFO units 4X and 4VW for Thorny skate.



894



Freq	Depth	Temp	Sal
F5	29	1.3	31.00
F25	45	3.7	32.50
F50	67	6.2	33.30
F75	91	8.1	34.40
F95	148	9.9	35.03

Figure 7.21E. Catch distribution by depth, temperature and salinity of Thorny skate.

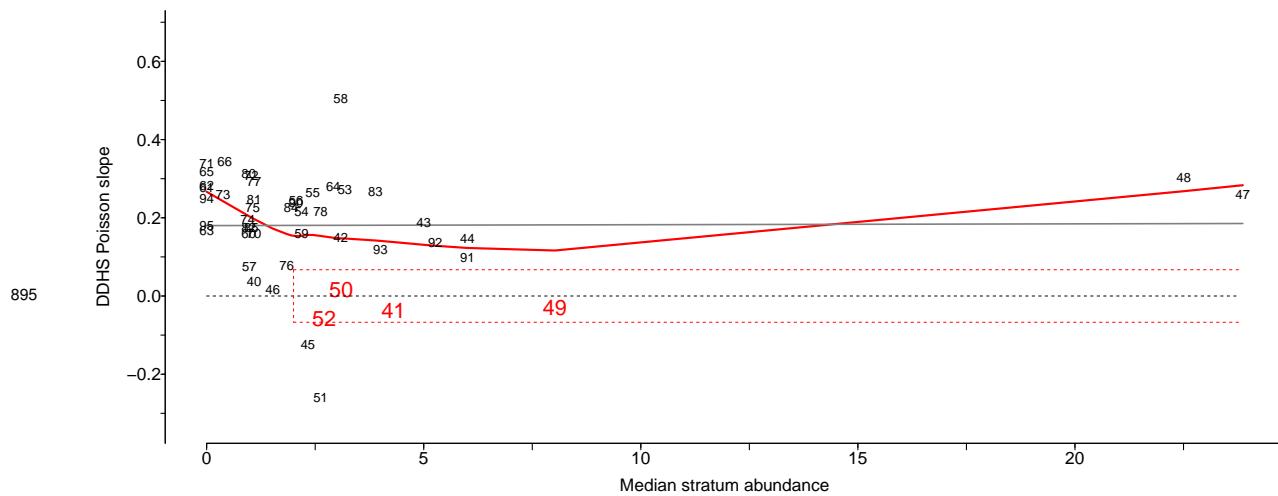


Figure 7.21F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Thorny skate.

896

## 7.22 Smooth skate (Raie lisse) - species code 202 (category LF)

897

Scientific name: [Malacoraja senta](#)

898

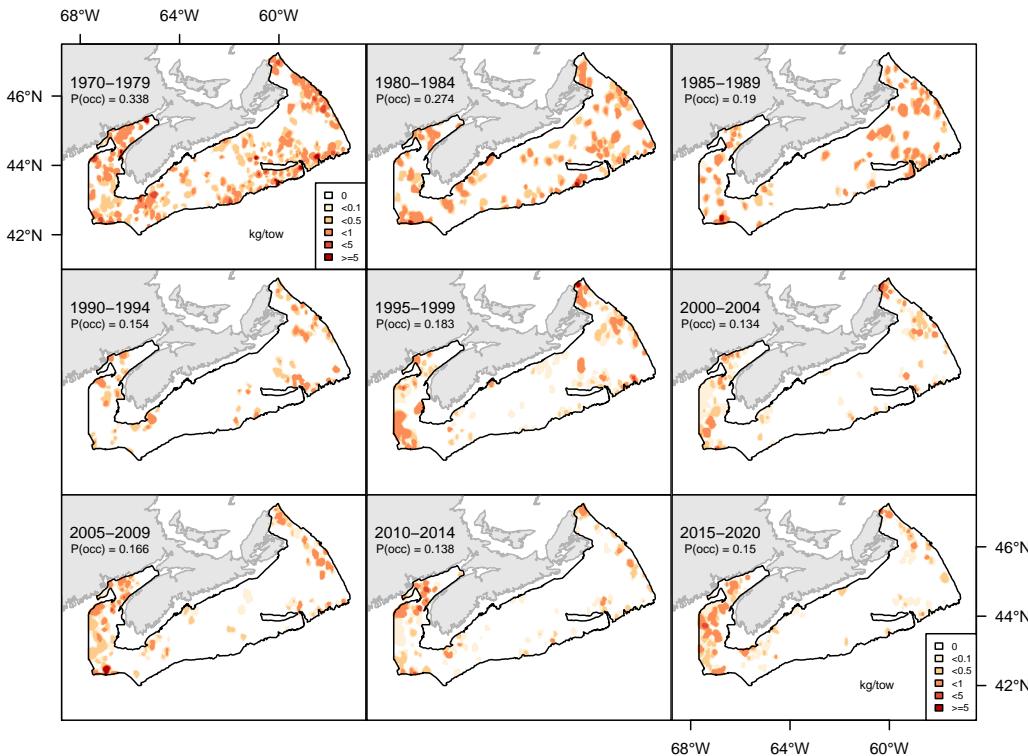


Figure 7.22A. Inverse distance weighted distribution of catch biomass (kg/tow) for Smooth skate.

899

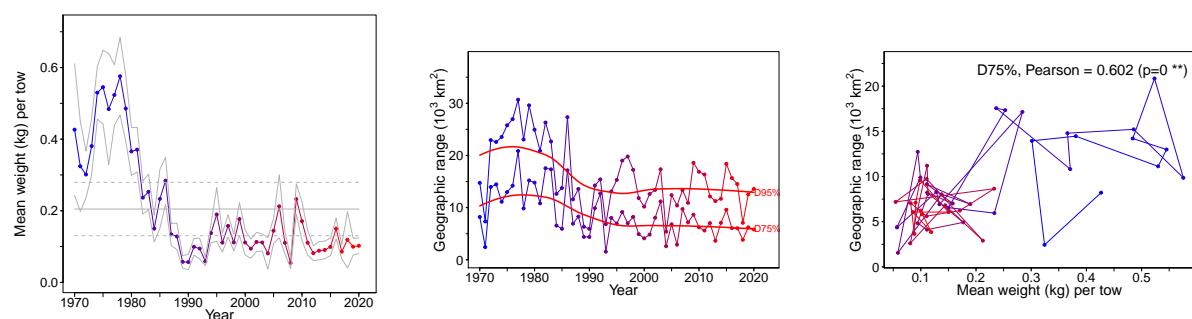


Figure 7.22B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Smooth skate.

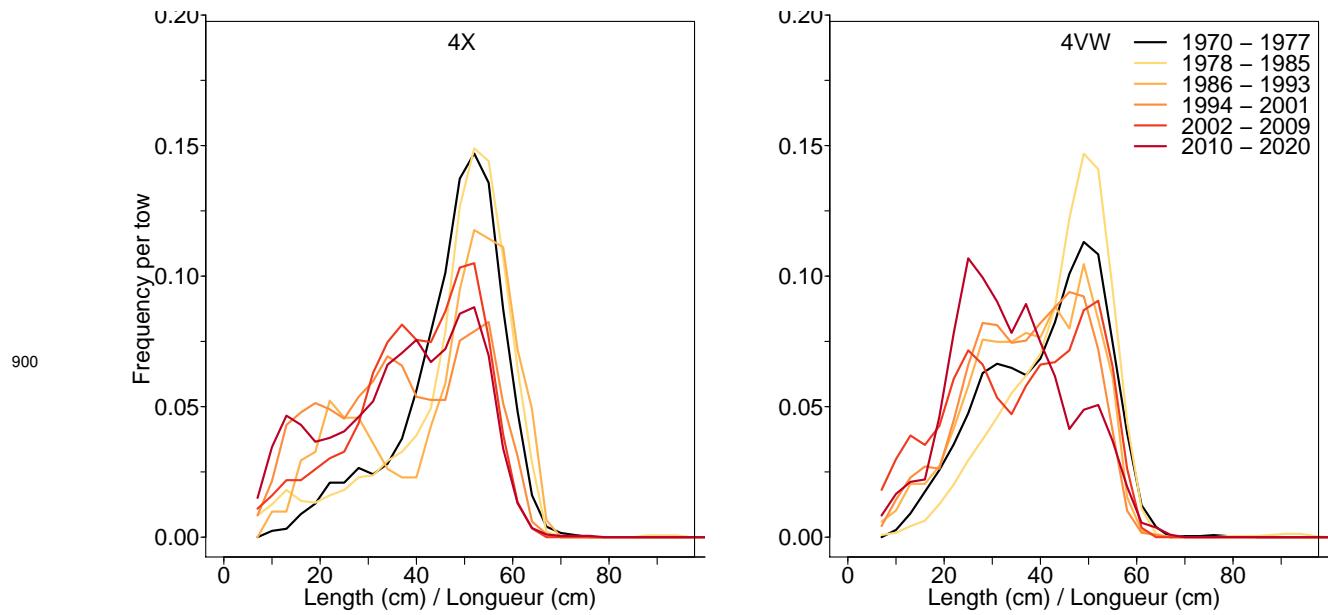


Figure 7.22C. Length frequency distribution in NAFO units 4X and 4VW for Smooth skate.

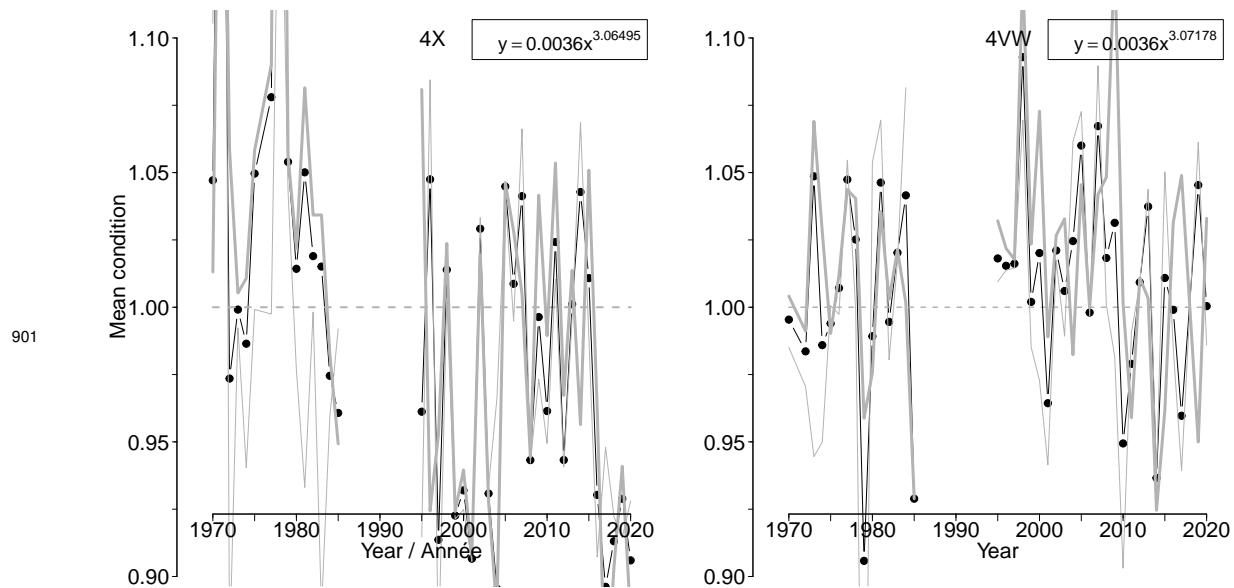
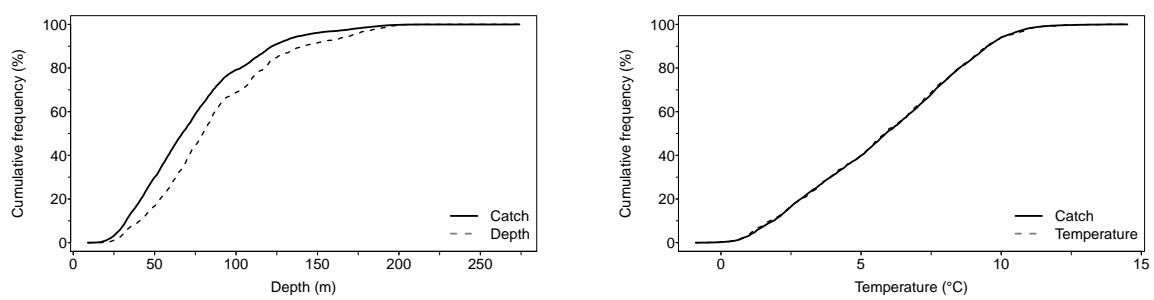
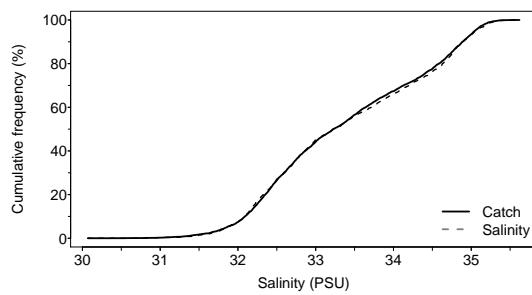


Figure 7.22D. Average fish condition in NAFO units 4X and 4VW for Smooth skate.



902



Freq	Depth	Temp	Sal
F5	33	1.2	31.00
F25	59	3.5	32.47
F50	80	5.9	33.23
F75	110	8.1	34.45
F95	171	10.0	35.06

Figure 7.22E. Catch distribution by depth, temperature and salinity of Smooth skate.

903

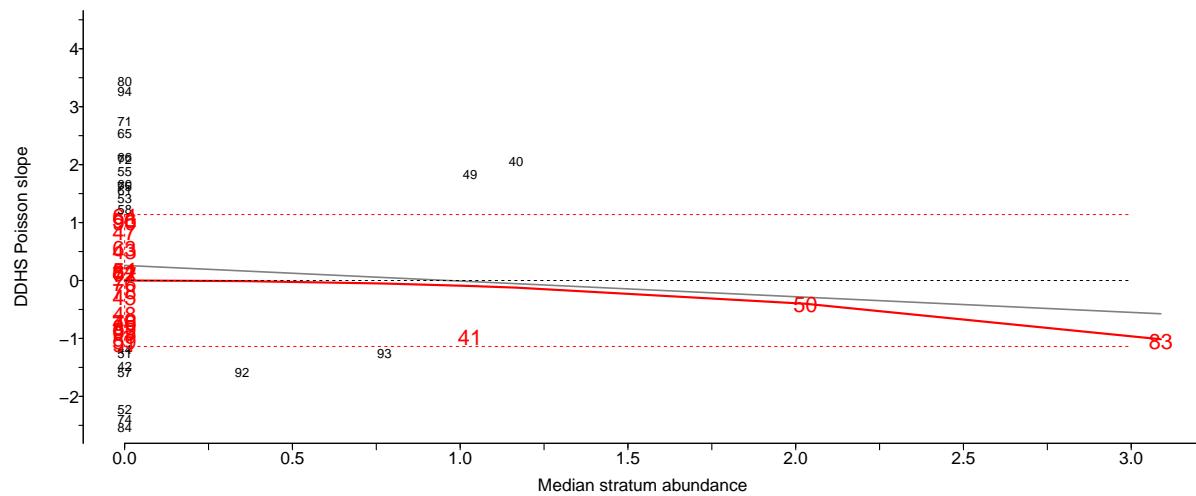


Figure 7.22F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Smooth skate.

904

## 7.23 Winter skate (Raie tachetée) - species code 204 (category LF)

905

Scientific name: [Leucoraja ocellata](#)

906

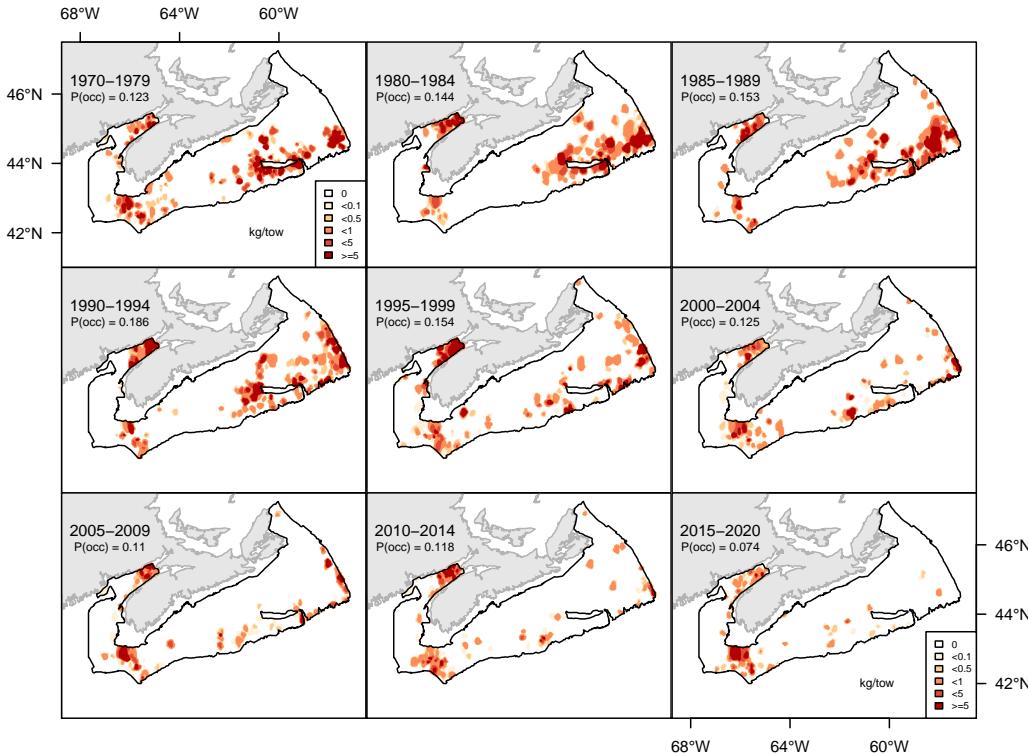


Figure 7.23A. Inverse distance weighted distribution of catch biomass (kg/tow) for Winter skate.

907

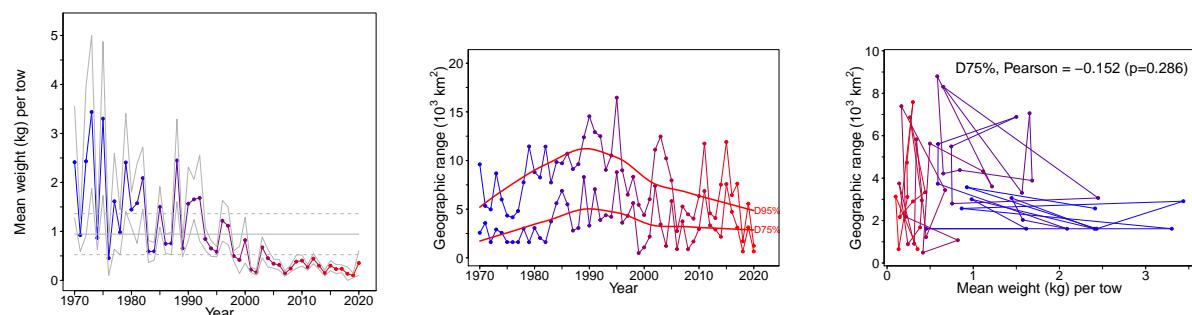


Figure 7.23B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Winter skate.

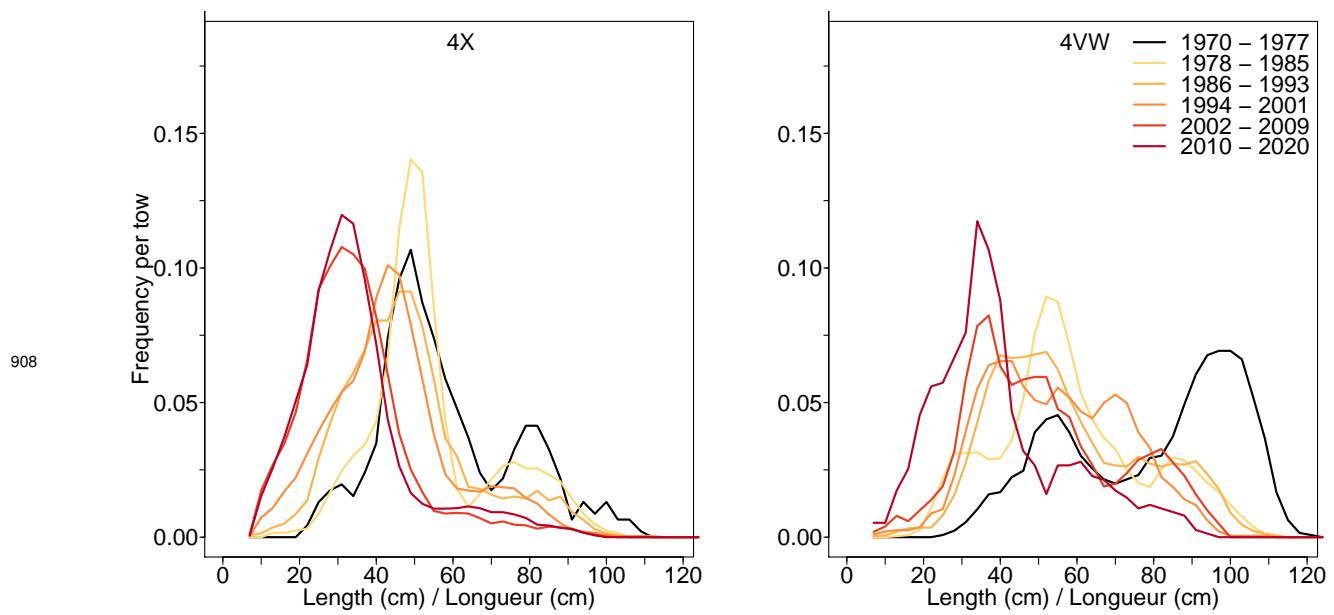


Figure 7.23C. Length frequency distribution in NAFO units 4X and 4VW for Winter skate.

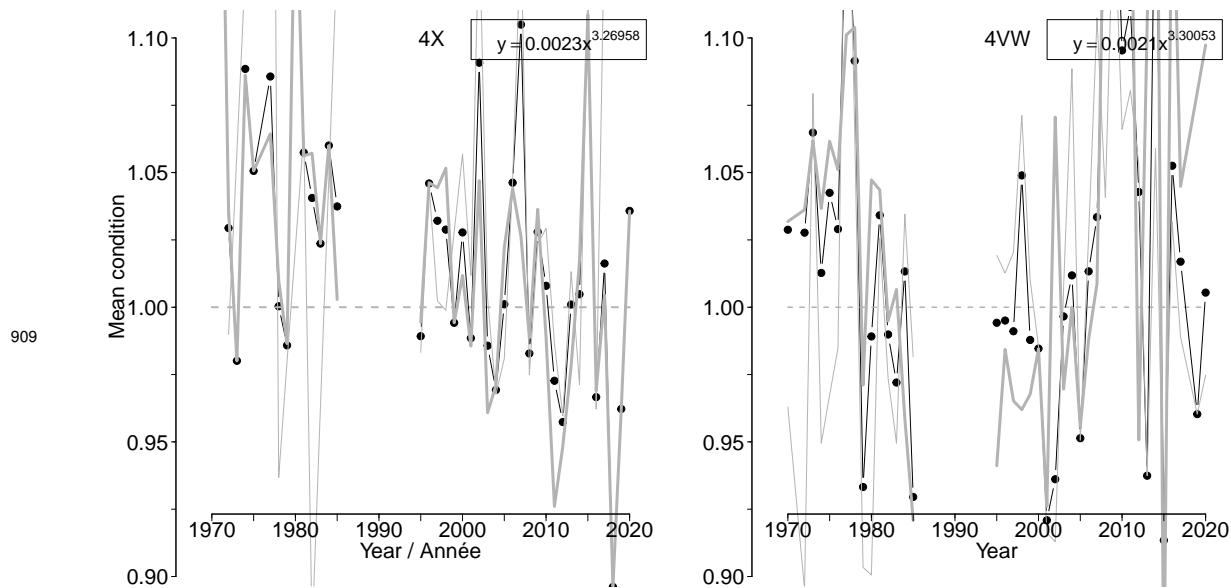
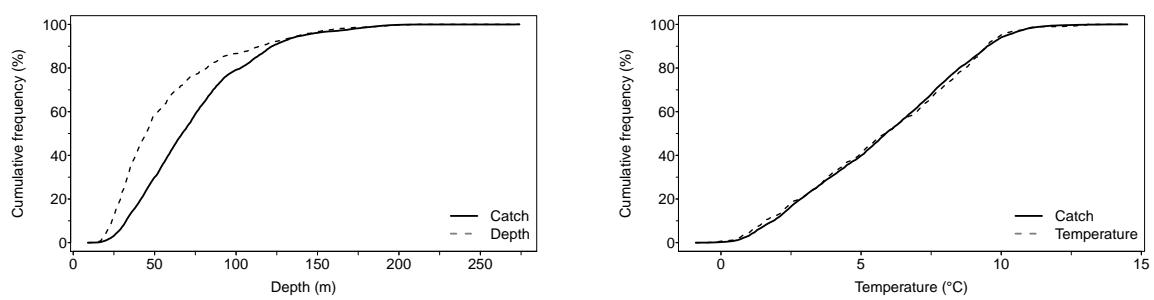
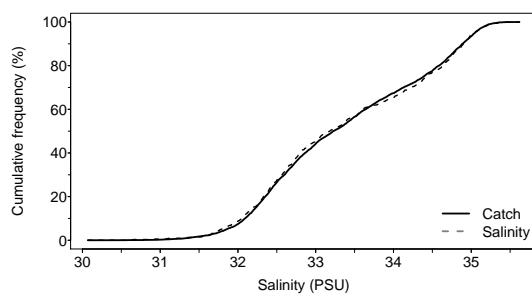


Figure 7.23D. Average fish condition in NAFO units 4X and 4VW for Winter skate.



910



Freq	Depth	Temp	Sal
F5	21	1.1	31.00
F25	32	3.5	32.44
F50	45	5.9	33.19
F75	71	8.3	34.42
F95	140	10.0	35.03

Figure 7.23E. Catch distribution by depth, temperature and salinity of Winter skate.

911

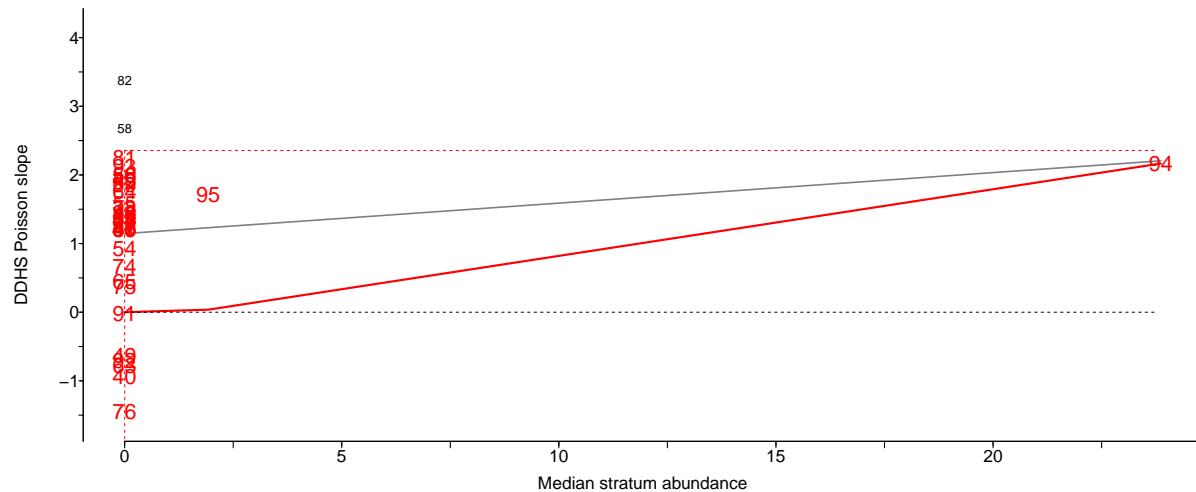


Figure 7.23F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Winter skate.

912

## 7.24 Picked dogfish (Aiguillat commun) - species code 220 (category LF)

913

Scientific name: [Squalus acanthias](#)

914

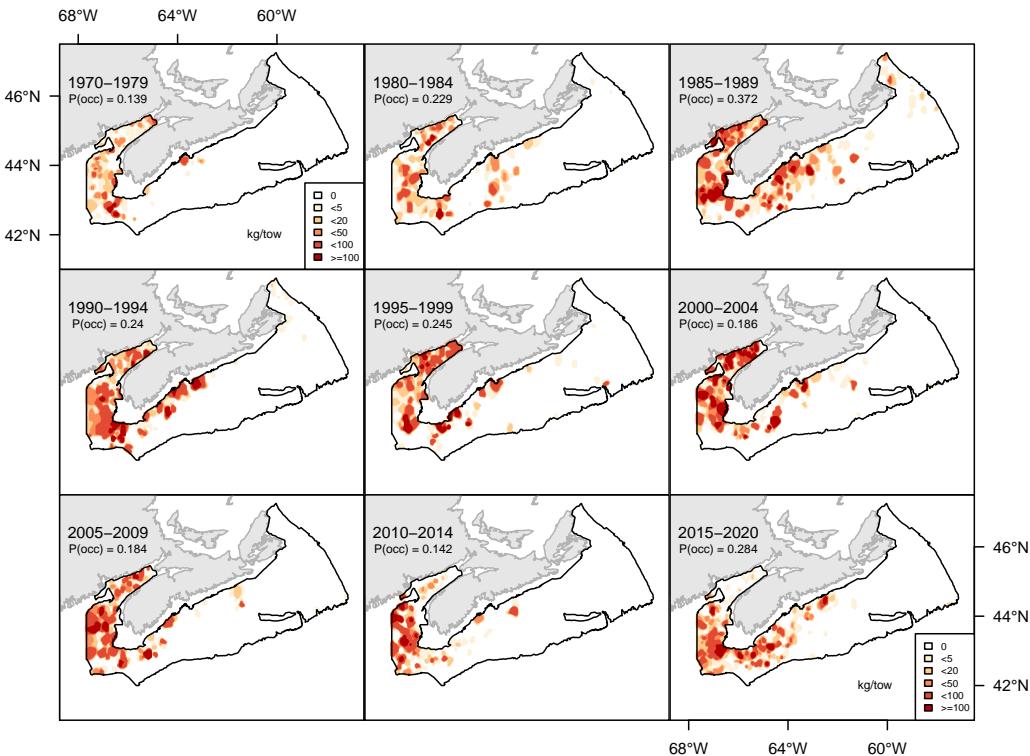


Figure 7.24A. Inverse distance weighted distribution of catch biomass (kg/tow) for Picked dogfish.

915

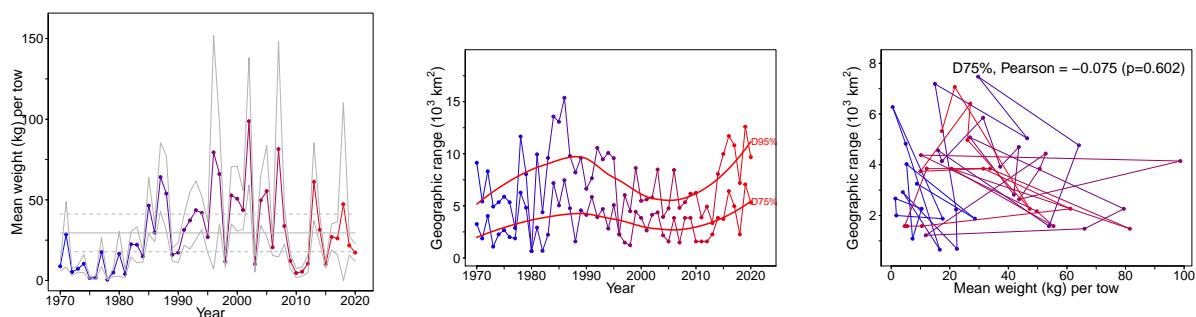


Figure 7.24B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Picked dogfish.

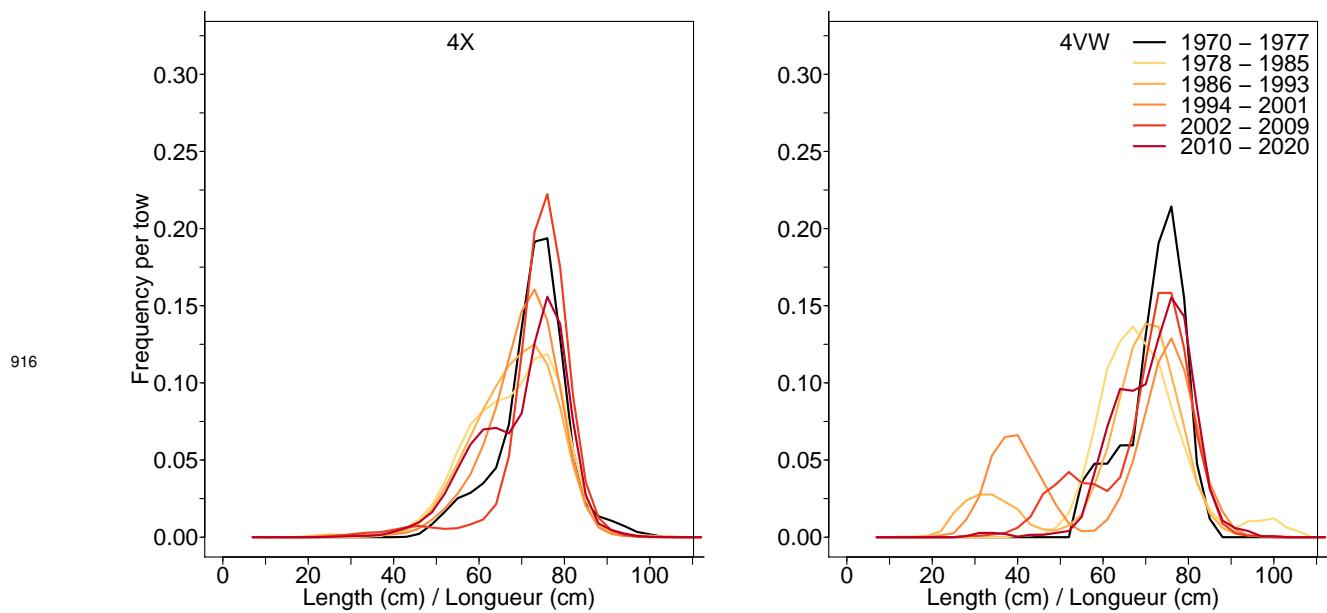


Figure 7.24C. Length frequency distribution in NAFO units 4X and 4VW for Picked dogfish.

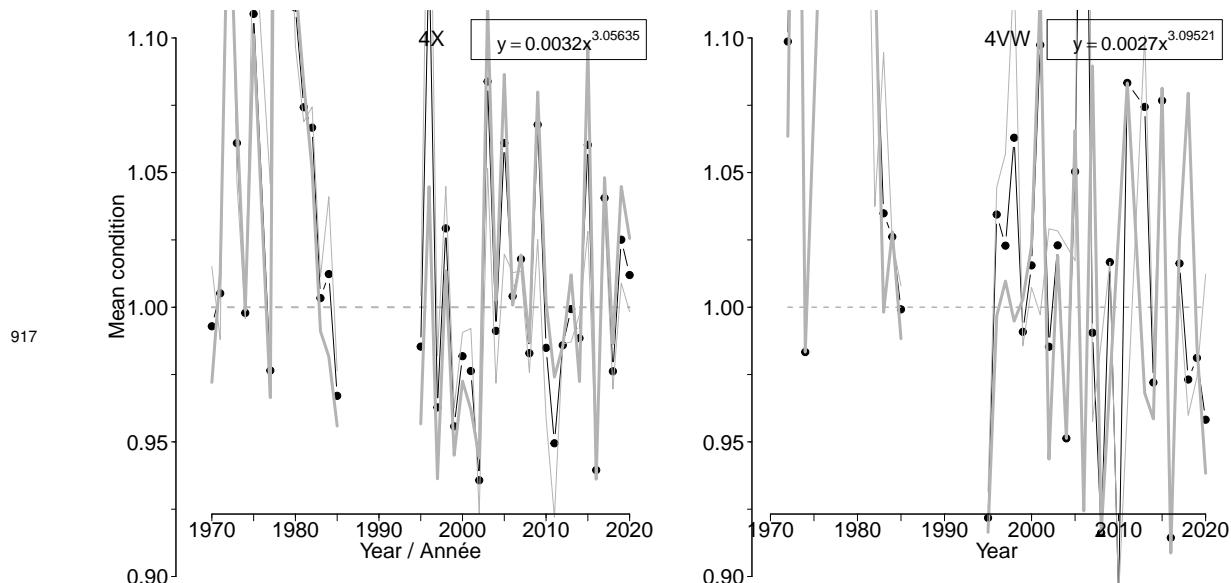
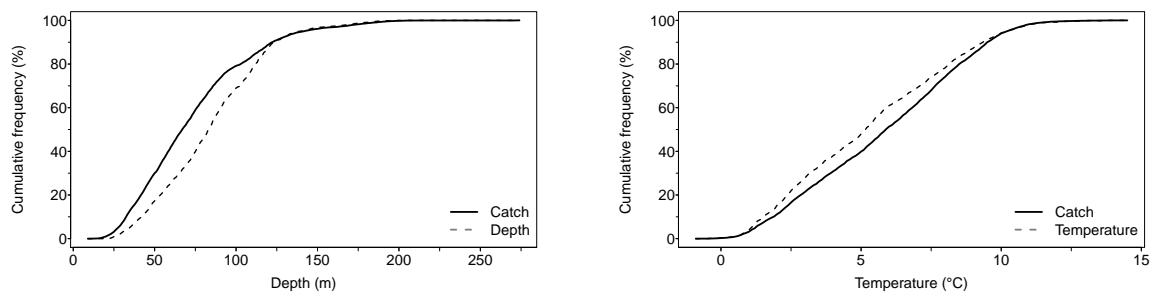
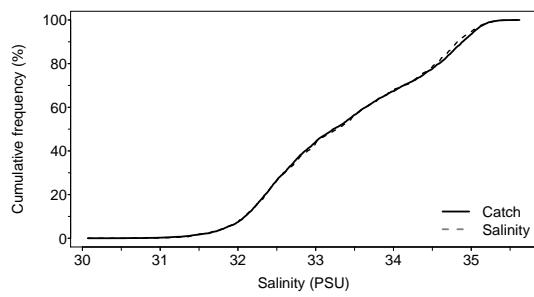


Figure 7.24D. Average fish condition in NAFO units 4X and 4VW for Picked dogfish.



918



Freq	Depth	Temp	Sal
F5	35	1.1	31.00
F25	60	2.8	32.47
F50	83	5.2	33.28
F75	108	7.7	34.37
F95	139	10.0	35.02

Figure 7.24E. Catch distribution by depth, temperature and salinity of Picked dogfish.

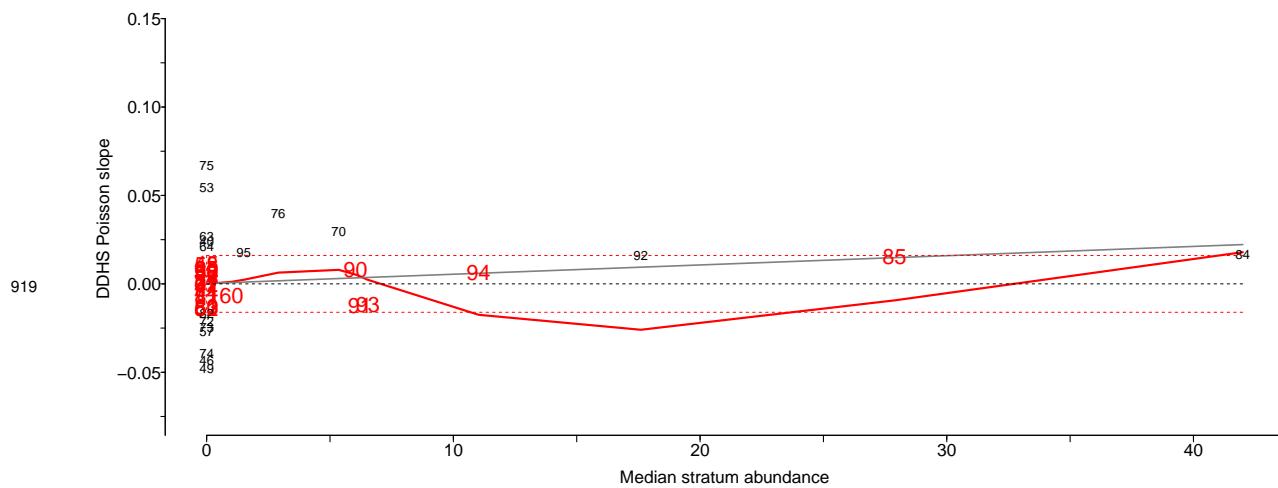


Figure 7.24F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Picked dogfish.

920      **7.25 Northern shortfin squid (*Encornet rouge nordique*) - species code 4511 (category  
921      LF)**

922      Scientific name: [Illex illecebrosus](#)

923

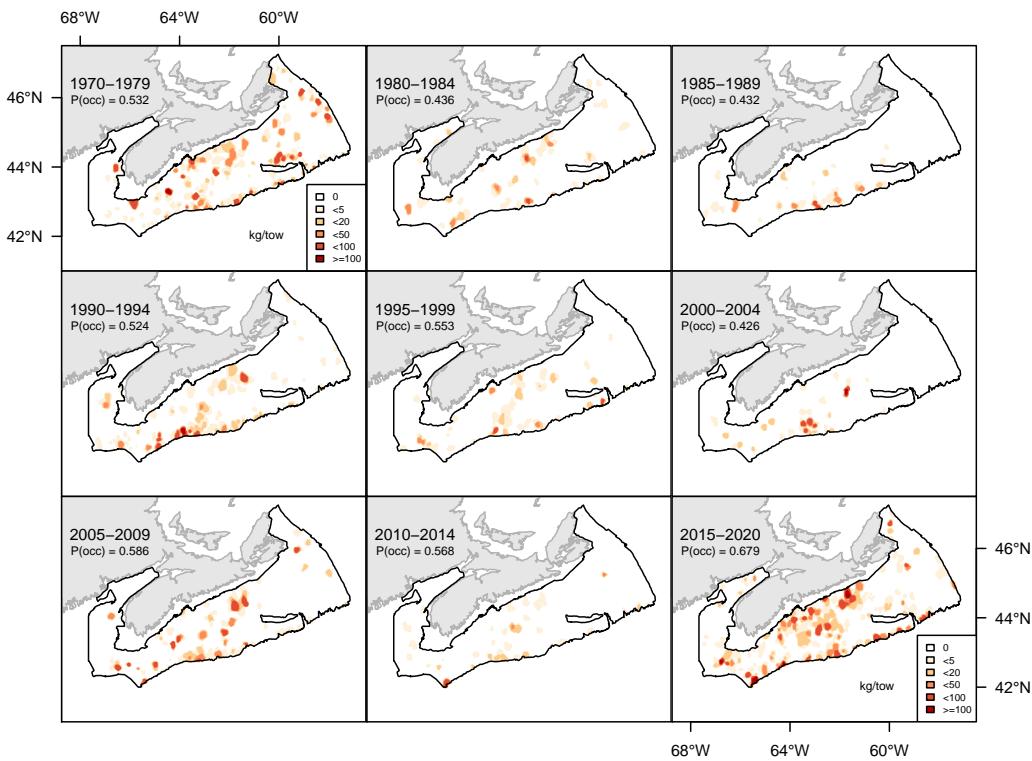


Figure 7.25A. Inverse distance weighted distribution of catch biomass (kg/tow) for Northern shortfin squid.

924

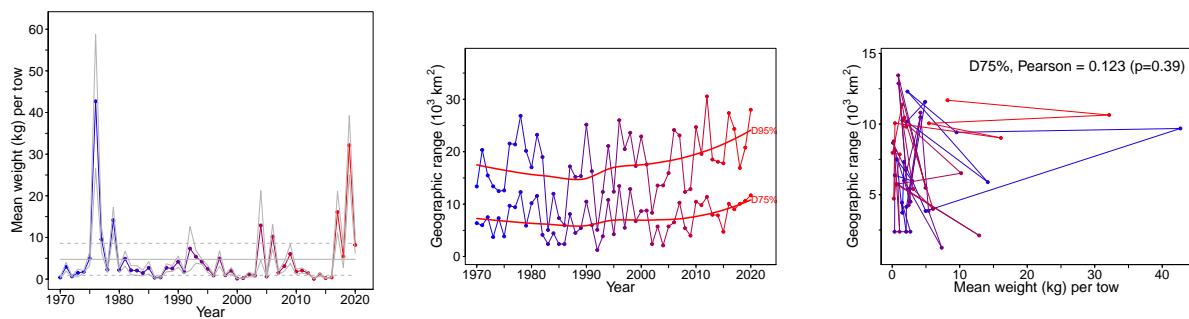


Figure 7.25B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Northern shortfin squid.

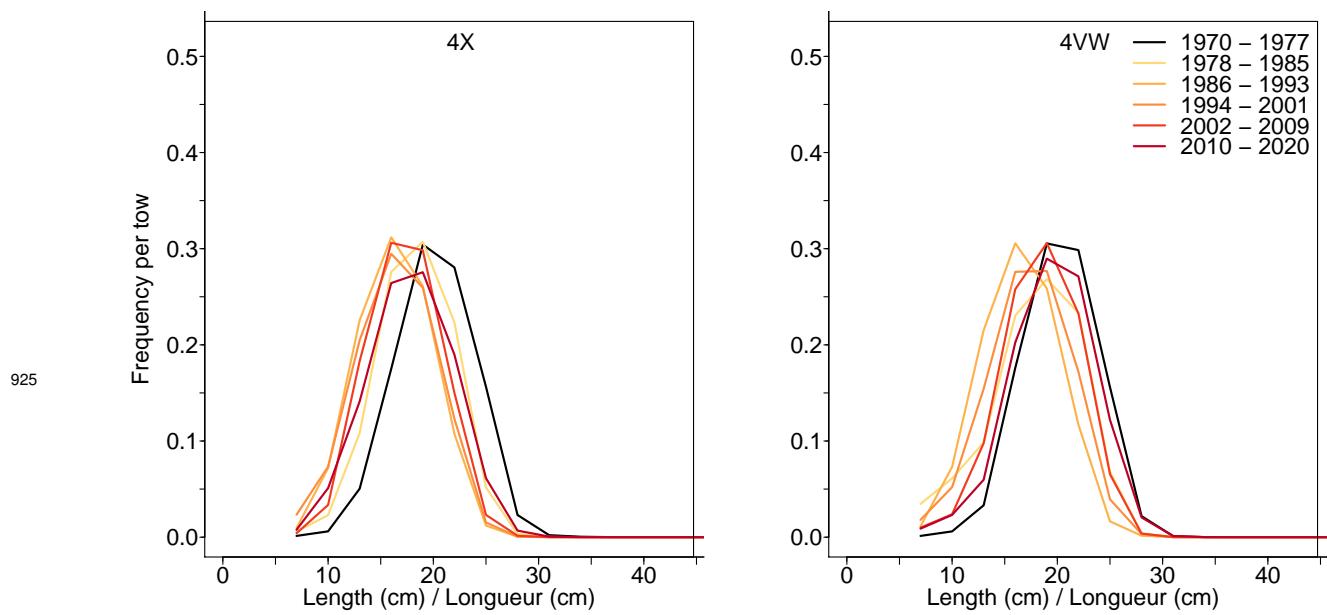


Figure 7.25C. Length frequency distribution in NAFO units 4X and 4VW for Northern shortfin squid.

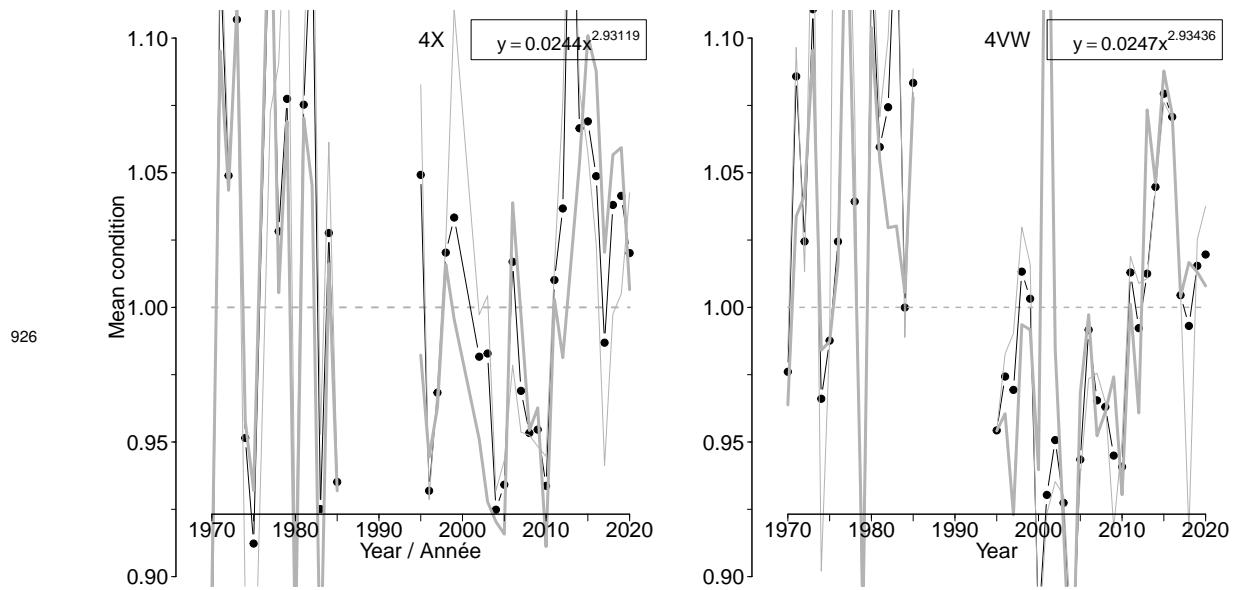
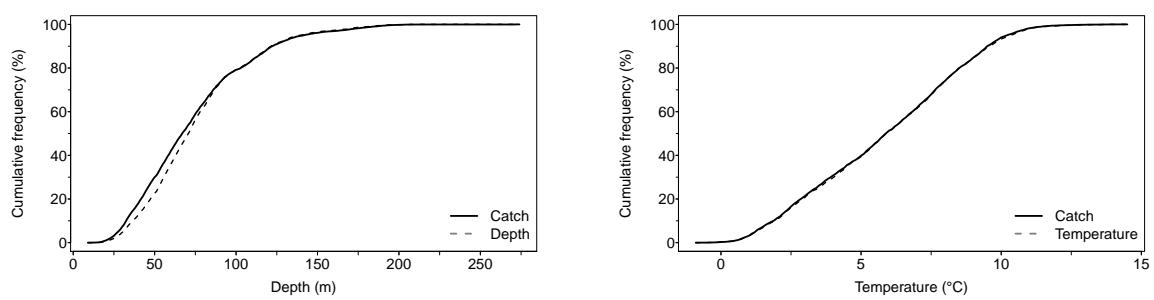
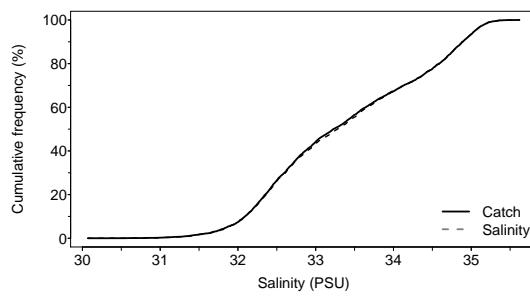


Figure 7.25D. Average fish condition in NAFO units 4X and 4VW for Northern shortfin squid.

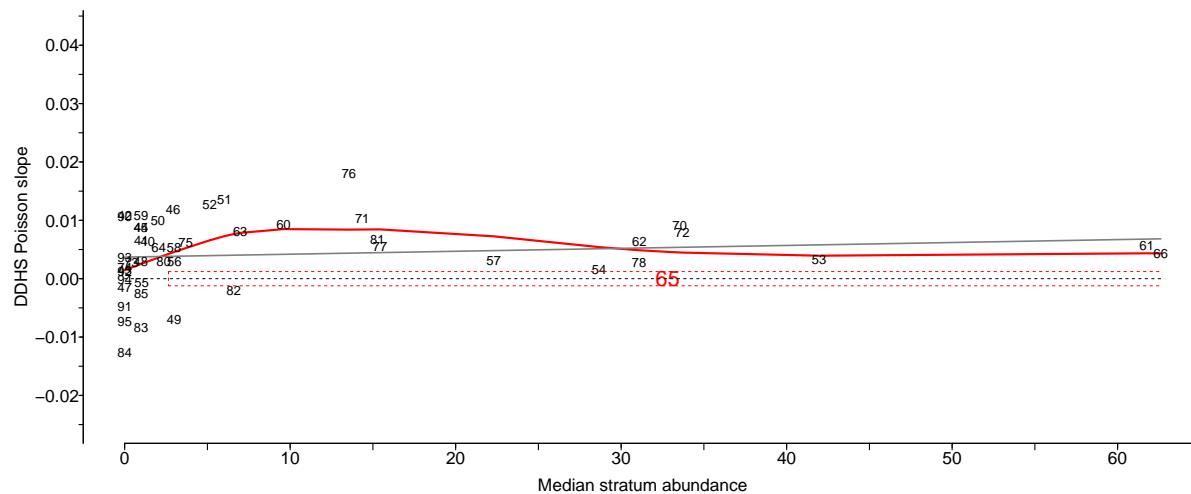


927



Freq	Depth	Temp	Sal
F5	31	1.3	31.00
F25	53	3.5	32.48
F50	71	5.9	33.28
F75	93	8.1	34.39
F95	139	10.0	35.05

Figure 7.25E. Catch distribution by depth, temperature and salinity of Northern shortfin squid.



928

Figure 7.25F. DDHS slopes versus median stratum abundance. The last two digits of each stratum number is shown in the figure for Northern shortfin squid.

929      **7.26 Atlantic hagfish (*Myxine du nord*) - species code 241 (category LI)**

930      Scientific name: [Myxine glutinosa](#)

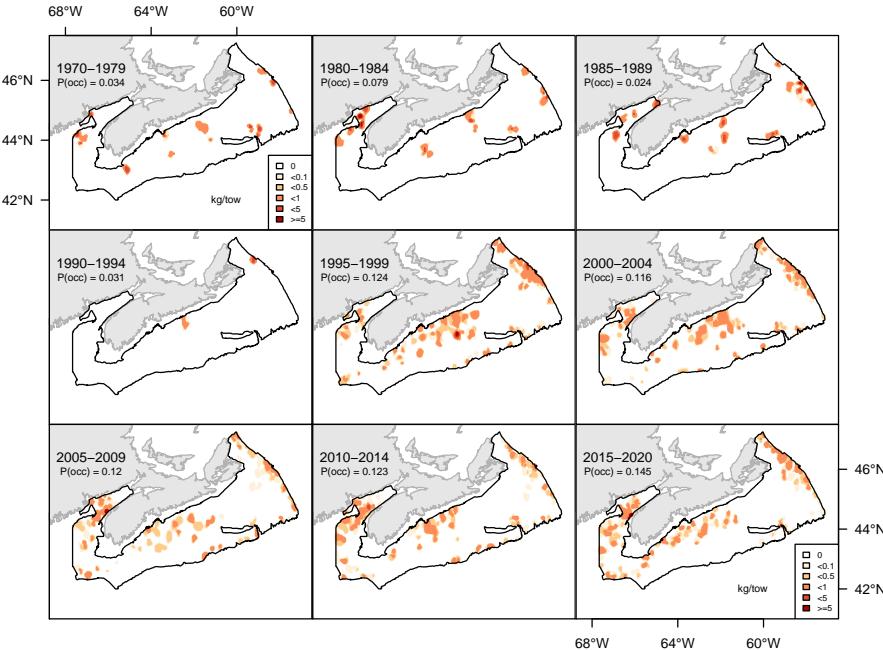


Figure 7.26A. Inverse distance weighted distribution of catch biomass (kg/tow) for Atlantic hagfish.

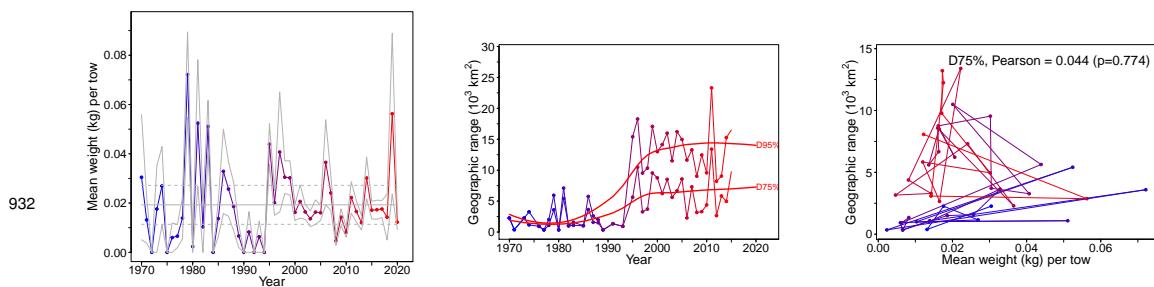


Figure 7.26B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Atlantic hagfish.

933

## 7.27 Cusk (Brosme) - species code 15 (category LI)

934

Scientific name: [Brosme brosme](#)

935

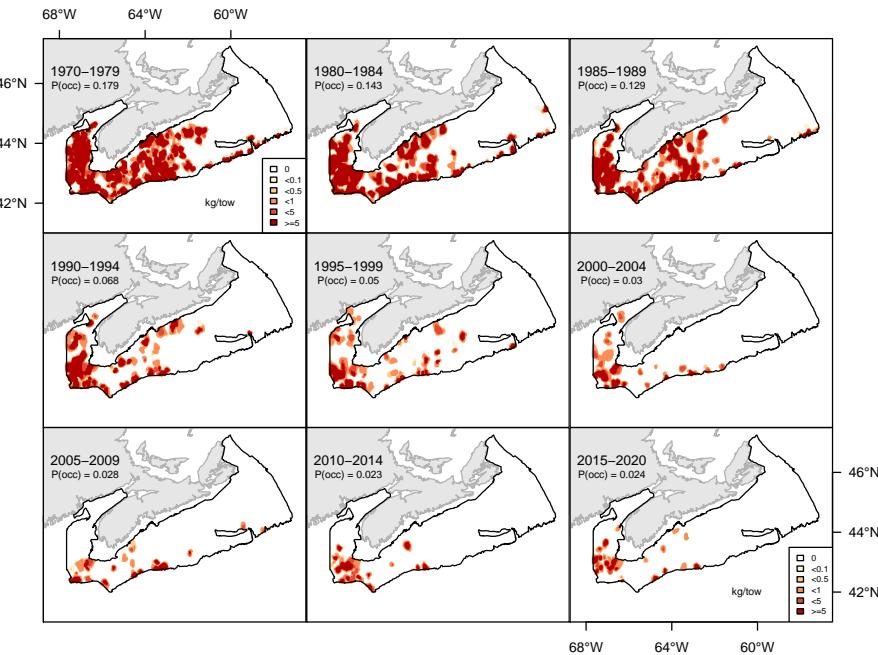


Figure 7.27A. Inverse distance weighted distribution of catch biomass (kg/tow) for Cusk.

936

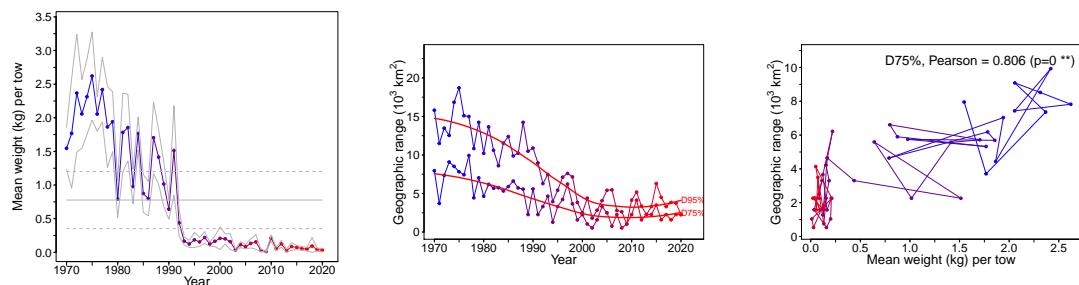


Figure 7.27B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Cusk.

937

## 7.28 Greenland halibut (Flétan noir) - species code 31 (category LI)

938

Scientific name: [Reinhardtius hippoglossoides](#)

939

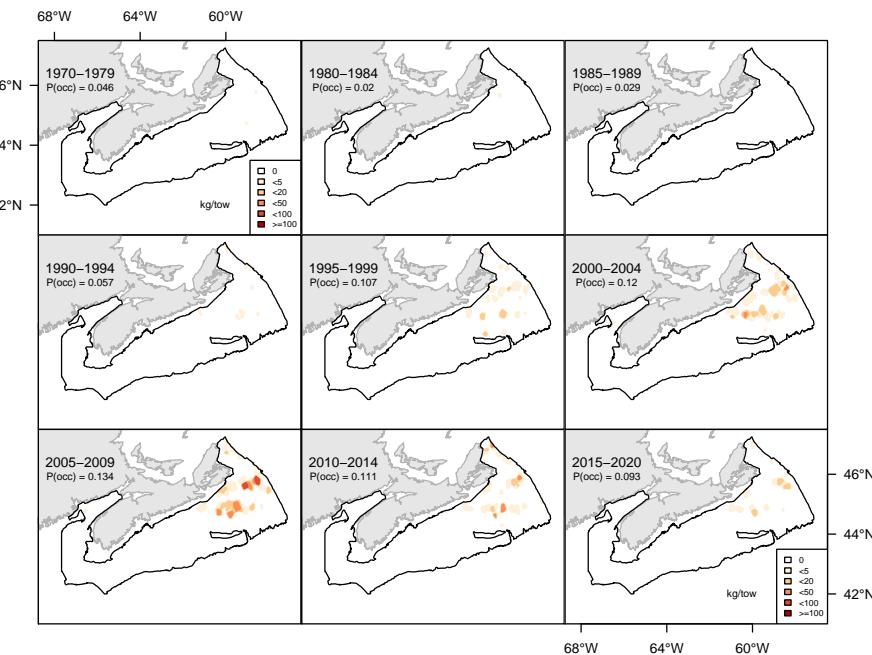


Figure 7.28A. Inverse distance weighted distribution of catch biomass (kg/tow) for Greenland halibut.

940

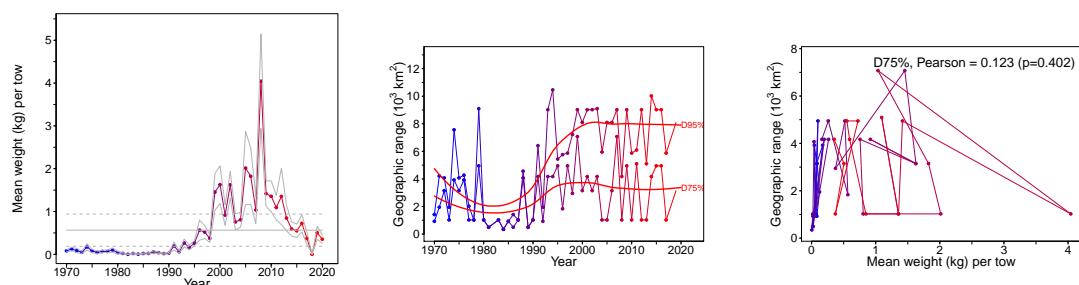


Figure 7.28B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Greenland halibut.

941      **7.29 Gulf Stream flounder (Ple du Gulf Stream) - species code 44 (category LI)**

942      Scientific name: [Citharichthys arctifrons](#)

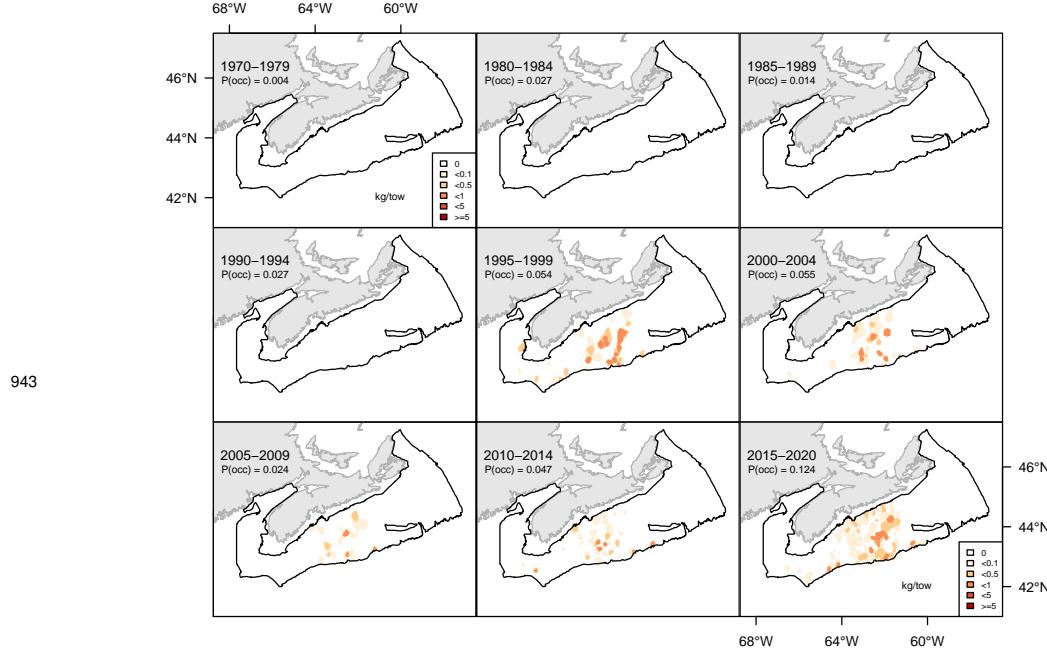


Figure 7.29A. Inverse distance weighted distribution of catch biomass (kg/tow) for Gulf Stream flounder.

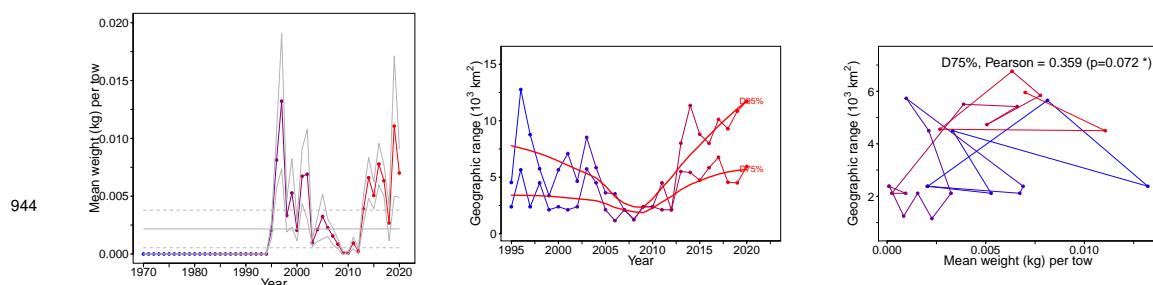


Figure 7.29B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Gulf Stream flounder.

945

### 7.30 American shad (*Alose savoureuse*) - species code 61 (category LI)

946

Scientific name: [Alosa sapidissima](#)

947

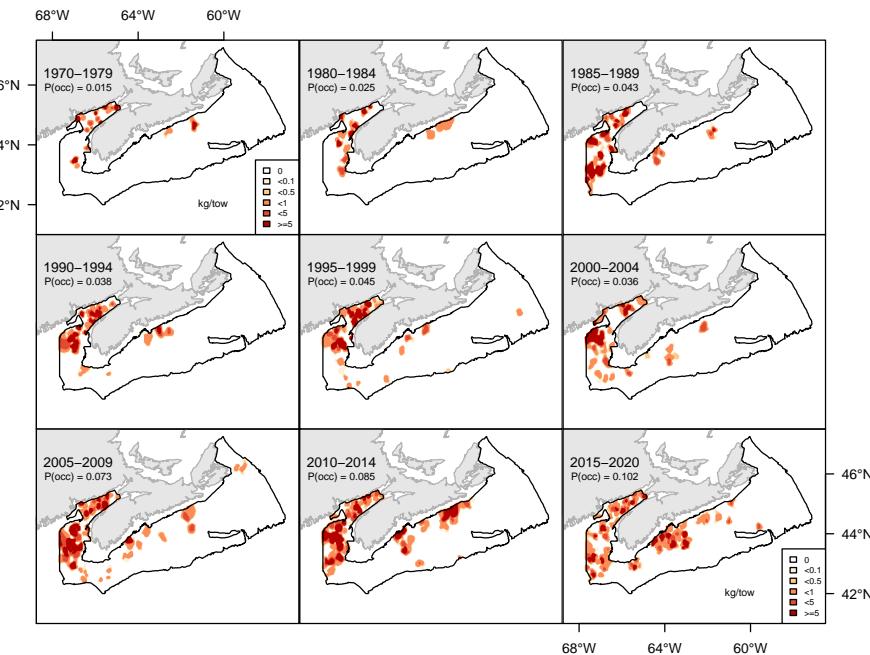


Figure 7.30A. Inverse distance weighted distribution of catch biomass (kg/tow) for American shad.

948

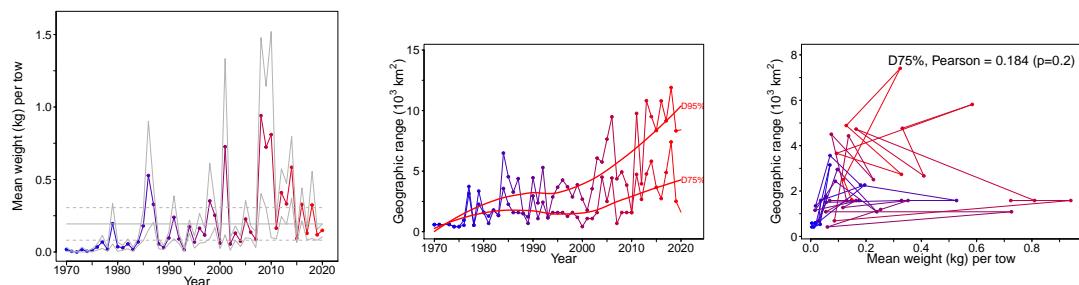


Figure 7.30B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of American shad.

949

### 7.31 Alewife (Gaspareau) - species code 62 (category LI)

950

Scientific name: *Alosa pseudoharengus*

951

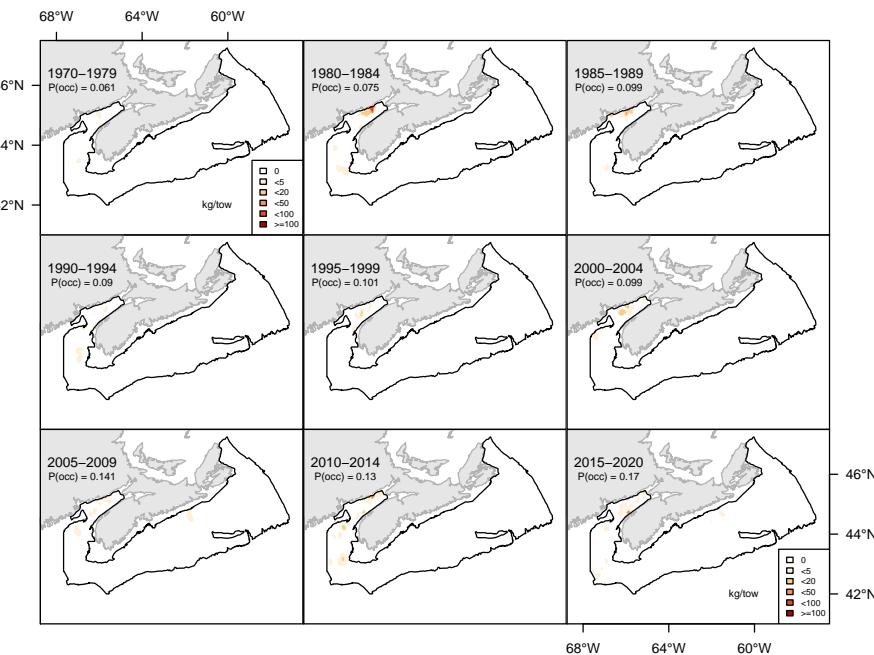


Figure 7.31A. Inverse distance weighted distribution of catch biomass (kg/tow) for Alewife.

952

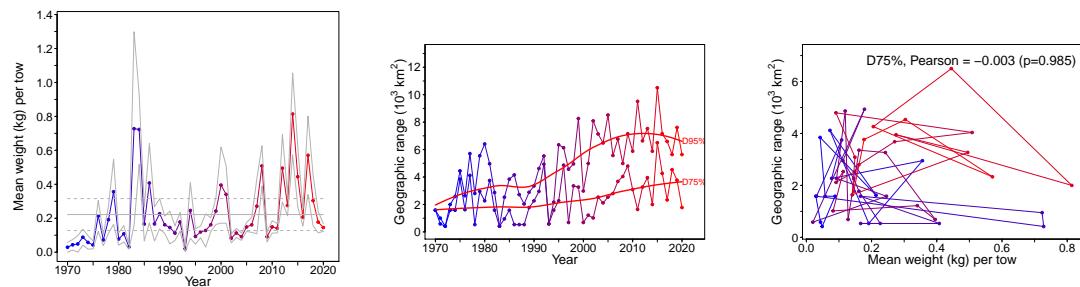


Figure 7.31B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Alewife.

953

### 7.32 Capelin (Capelan) - species code 64 (category LI)

954

Scientific name: [Mallotus villosus](#)

955

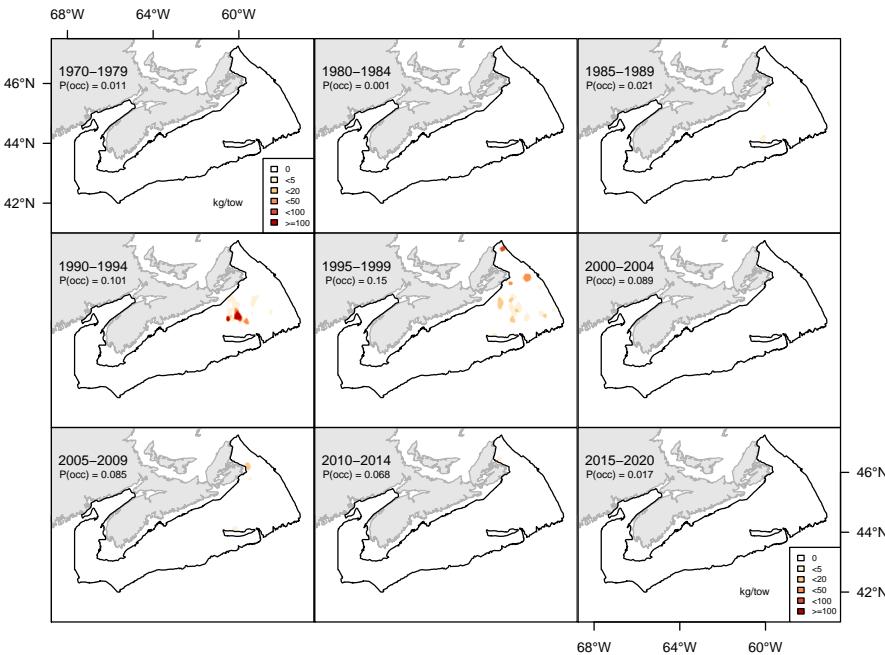


Figure 7.32A. Inverse distance weighted distribution of catch biomass (kg/tow) for Capelin.

956

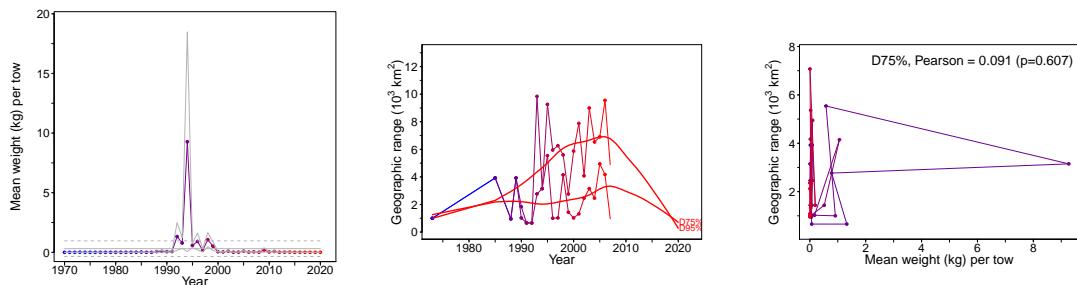


Figure 7.32B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Capelin.

957      **7.33 Atlantic mackerel (*Maquereau commun*) - species code 70 (category LI)**

958      Scientific name: *Scomber scombrus*

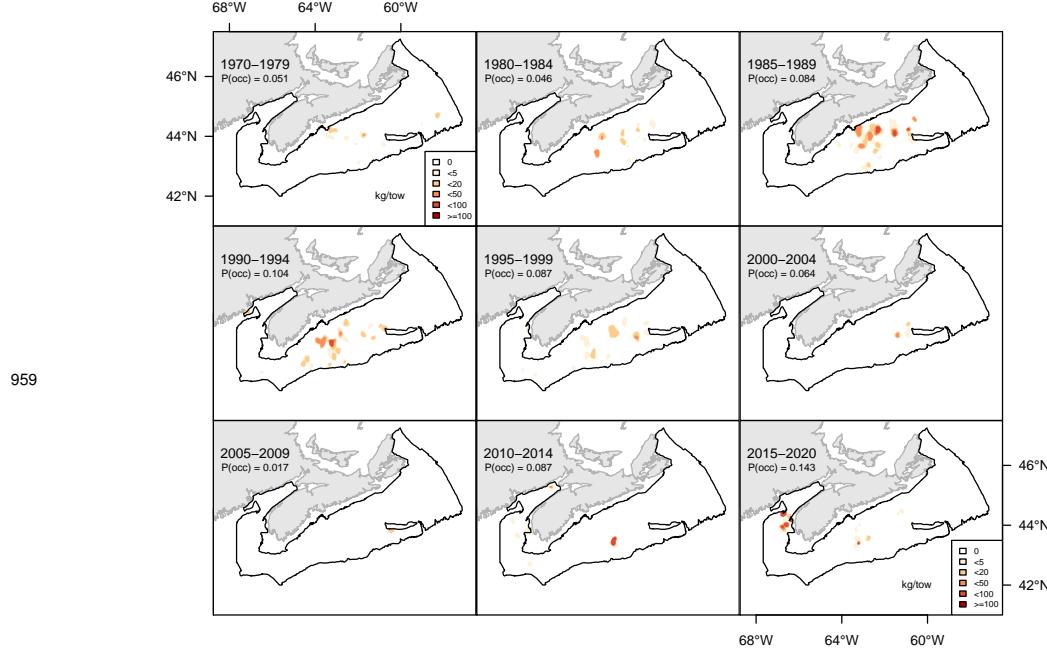


Figure 7.33A. Inverse distance weighted distribution of catch biomass (kg/tow) for Atlantic mackerel.

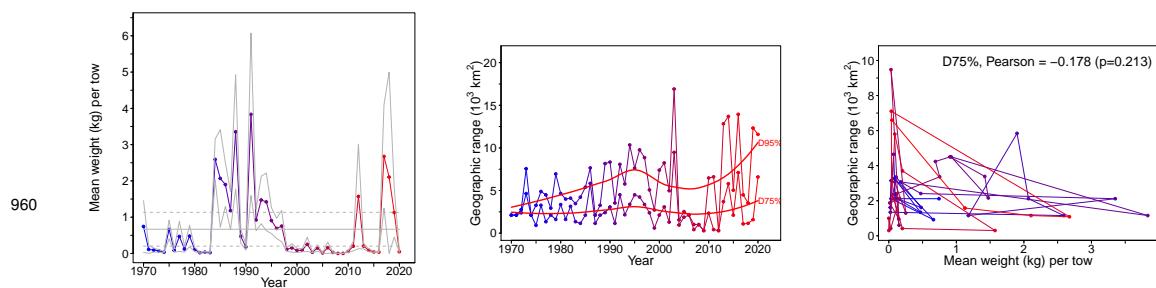


Figure 7.33B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Atlantic mackerel.

961      **7.34 Longfin hake (*Merluche à longues nageoires*) - species code 112 (category LI)**

962      Scientific name: [Phycis chesteri](#)

963

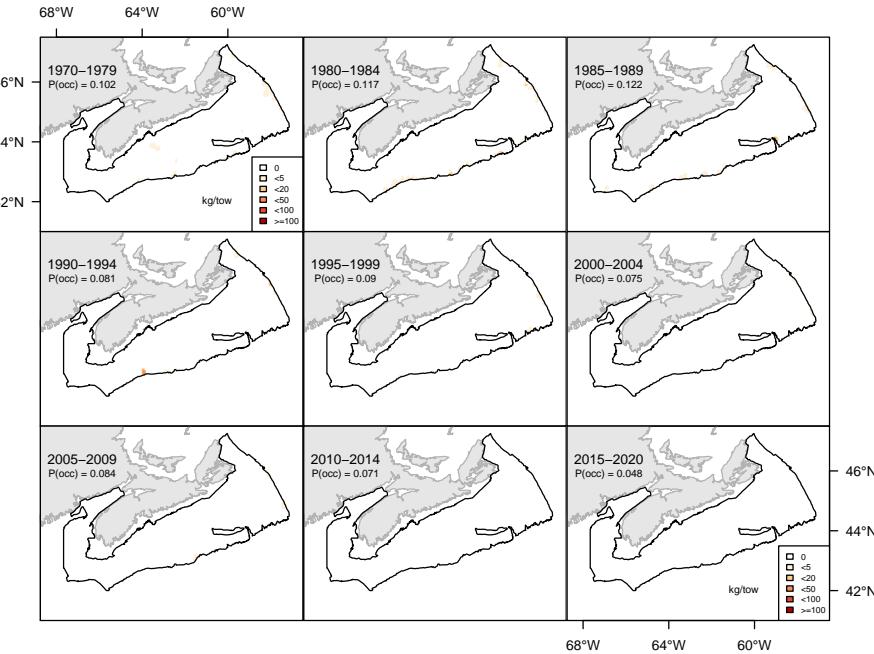


Figure 7.34A. Inverse distance weighted distribution of catch biomass (kg/tow) for Longfin hake.

964

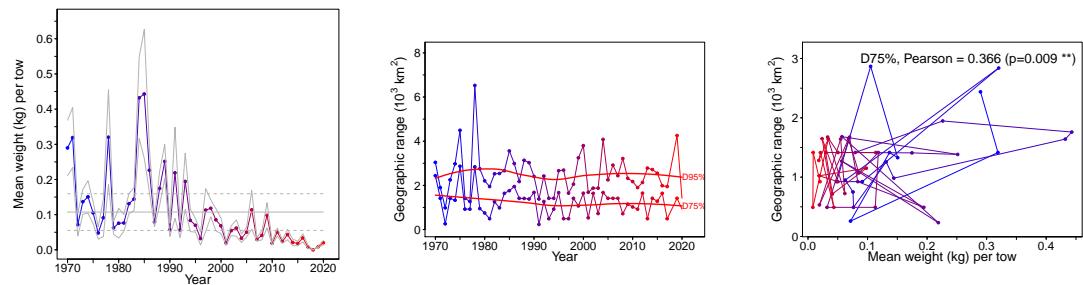


Figure 7.34B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Longfin hake.

965      **7.35 Fourbeard rockling (Motelle à quatre barbillons) - species code 114 (category LI)**

966      Scientific name: [Enchelyopus cimbrius](#)

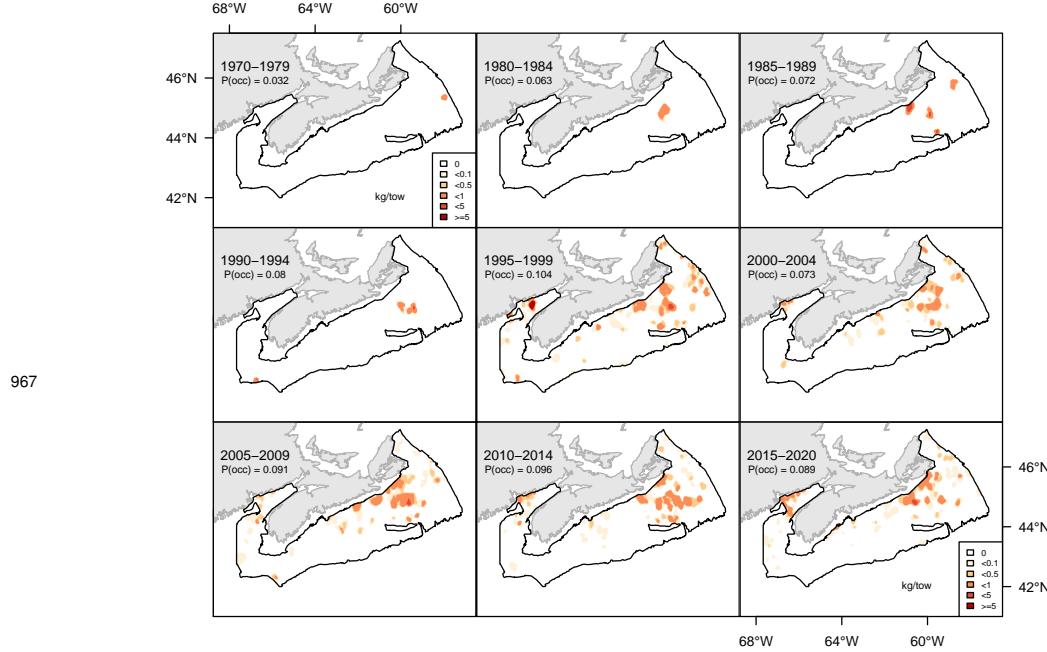


Figure 7.35A. Inverse distance weighted distribution of catch biomass (kg/tow) for Fourbeard rockling.

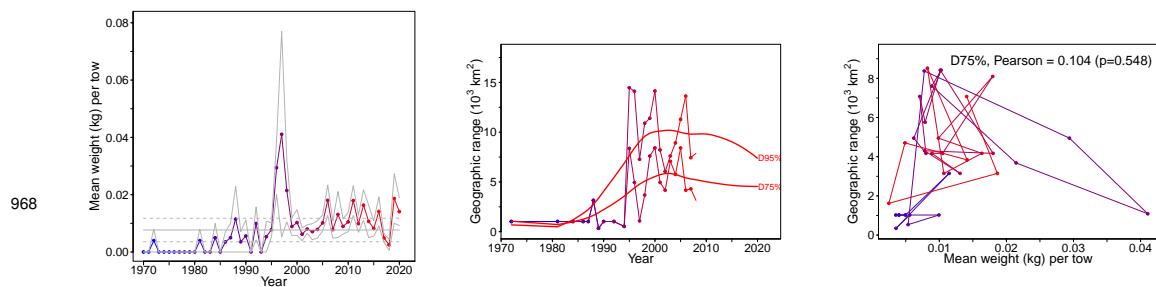


Figure 7.35B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Fourbeard rockling.

969

### 7.36 Blackbelly rosefish (Sébaste chèvre) - species code 123 (category LI)

970

Scientific name: [Helicolenus dactylopterus](#)

971

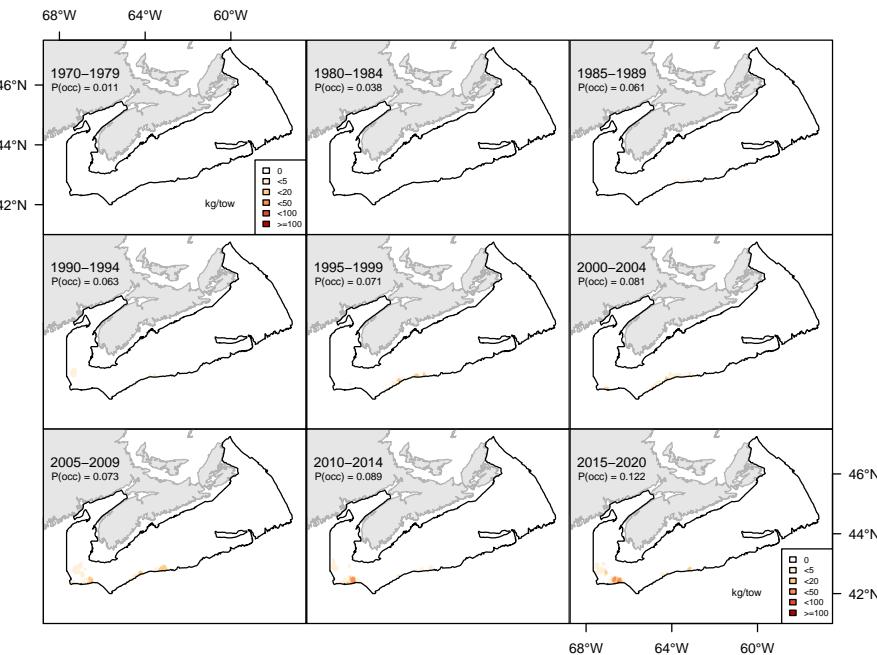


Figure 7.36A. Inverse distance weighted distribution of catch biomass (kg/tow) for Blackbelly rosefish.

972

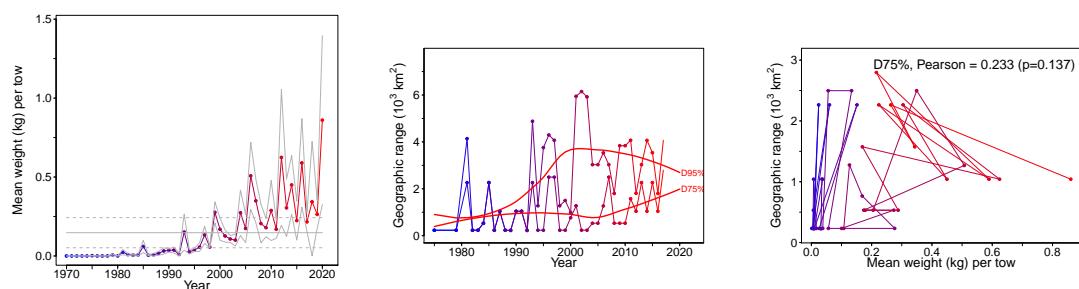


Figure 7.36B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Blackbelly rosefish.

973

### 7.37 Greater argentine (Grande argentine) - species code 160 (category LI)

974

Scientific name: [Argentina silus](#)

975

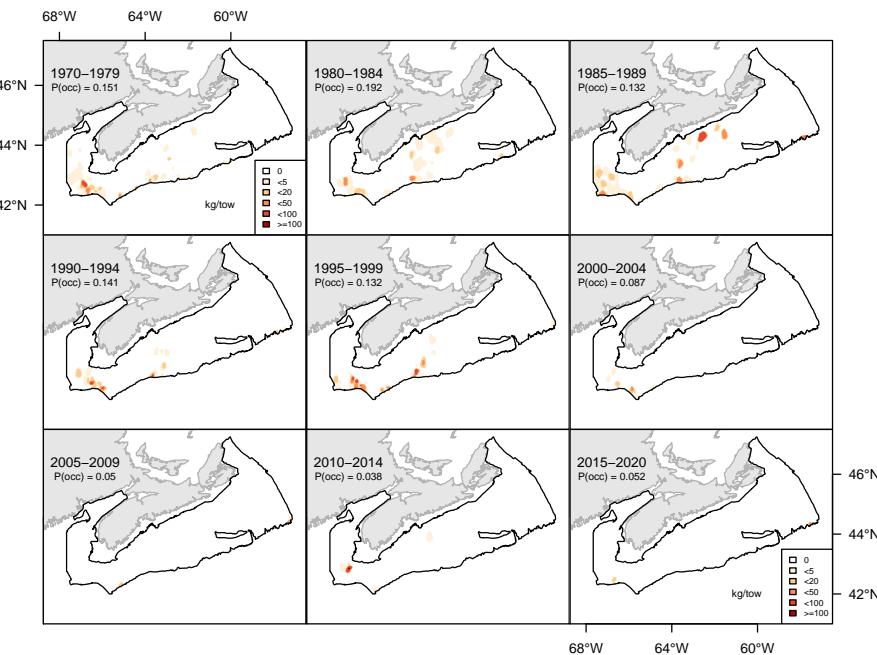


Figure 7.37A. Inverse distance weighted distribution of catch biomass (kg/tow) for Greater argentine.

976

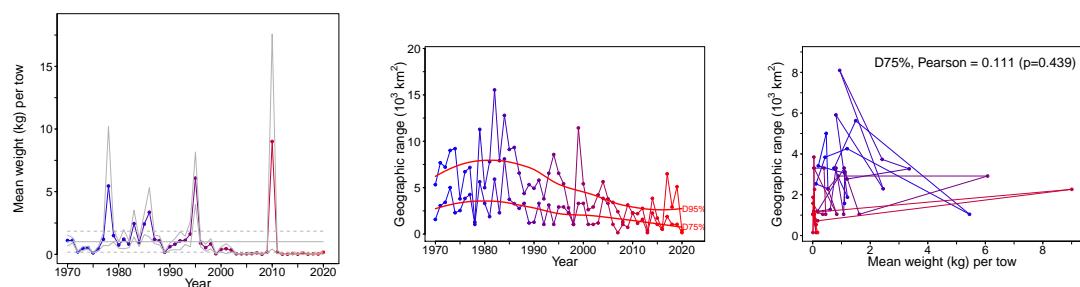


Figure 7.37B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Greater argentine.

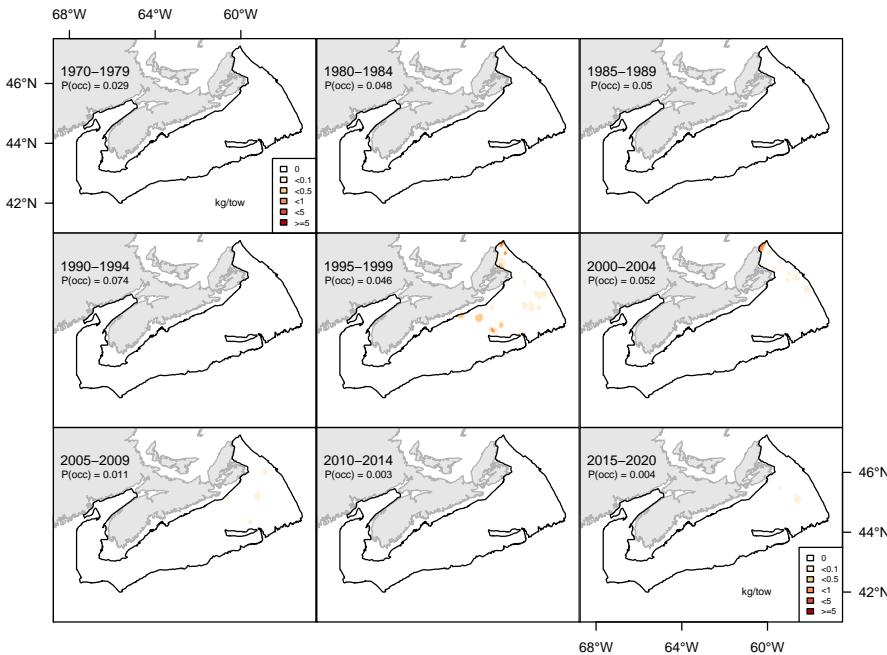
977

### 7.38 Arctic hookear sculpin (*Hameçon neigeux*) - species code 306 (category LI)

978

Scientific name: [Artediellus uncinatus](#)

979



980

Figure 7.38A. Inverse distance weighted distribution of catch biomass (kg/tow) for Arctic hookear sculpin.

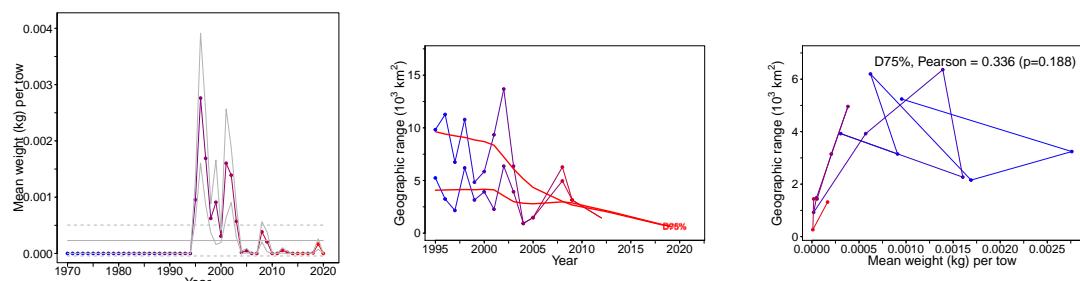


Figure 7.38B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Arctic hookear sculpin.

981      **7.39 Atlantic poacher (*Agone atlantique*) - species code 350 (category LI)**

982      Scientific name: [Leptagonus decagonus](#)

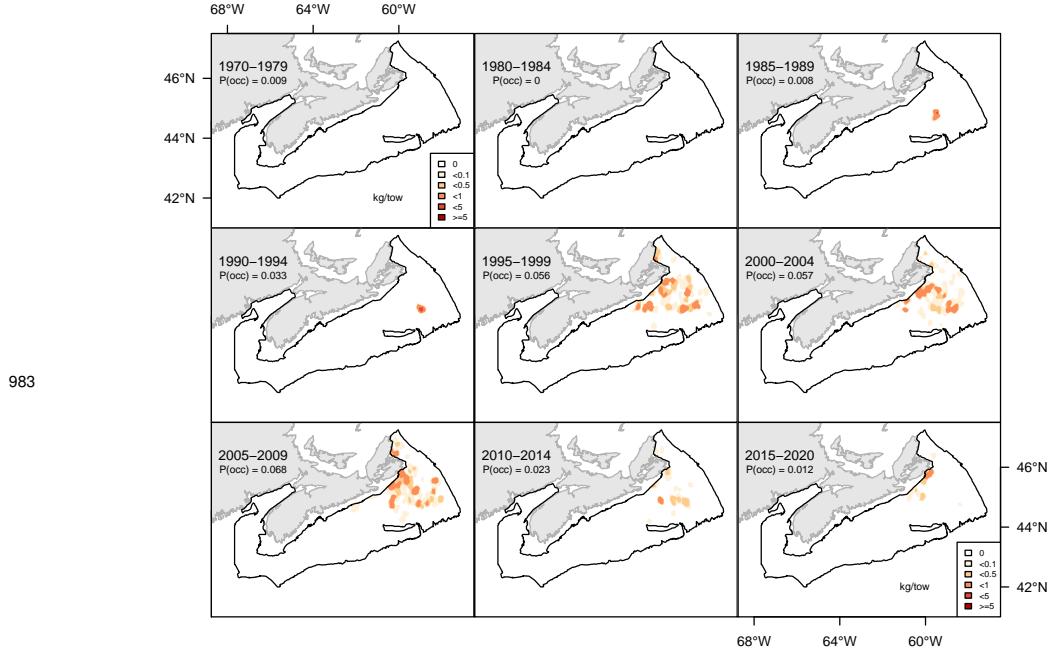


Figure 7.39A. Inverse distance weighted distribution of catch biomass (kg/tow) for Atlantic poacher.

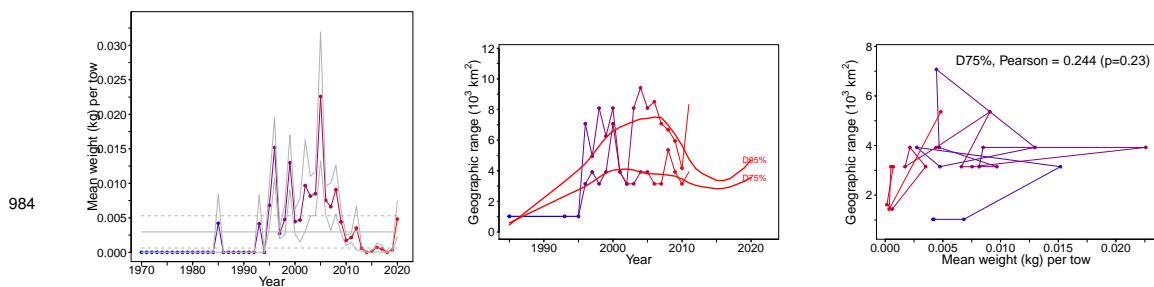


Figure 7.39B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Atlantic poacher.

985      **7.40 Marlin-spike grenadier (Grenadier du Grand Banc) - species code 410 (category**  
 986      **LI)**

987      Scientific name: [Nezumia bairdii](#)

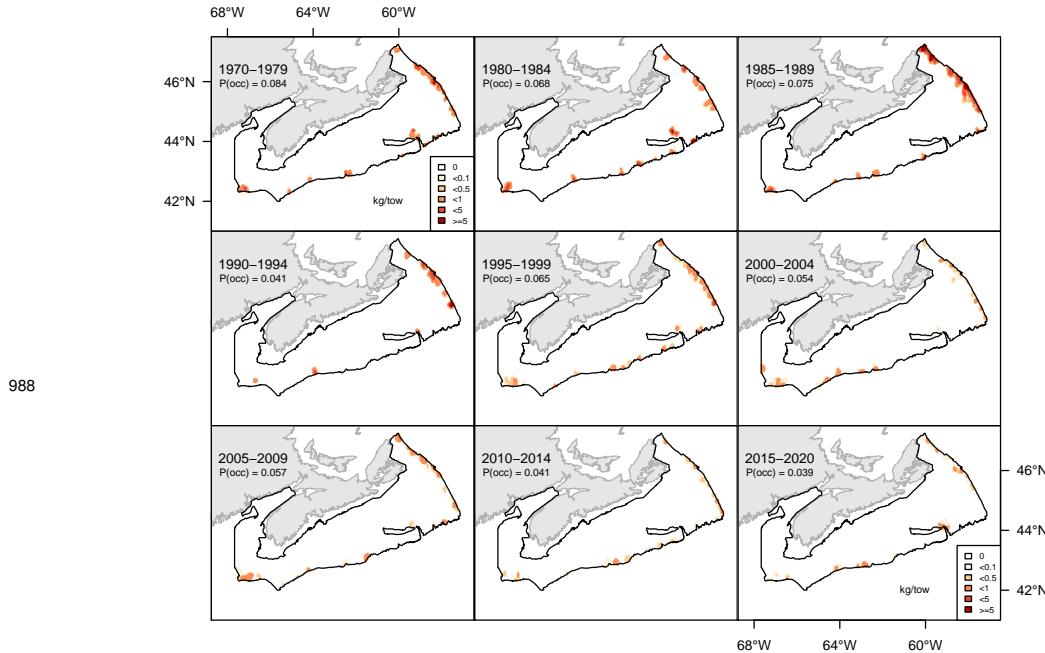


Figure 7.40A. Inverse distance weighted distribution of catch biomass (kg/tow) for Marlin-spike grenadier.

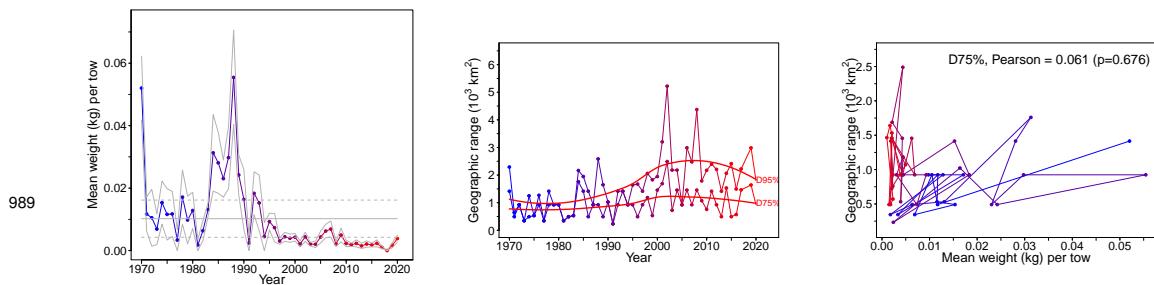


Figure 7.40B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Marlin-spike grenadier.

990      **7.41 Lumpfish (Lompe) - species code 501 (category LI)**

991      Scientific name: [Cyclopterus lumpus](#)

992

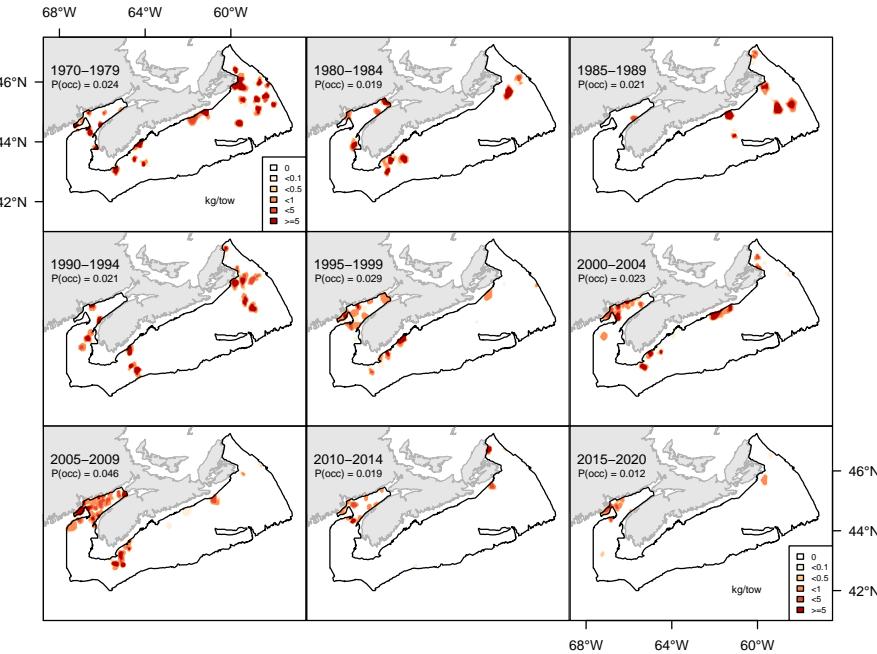


Figure 7.41A. Inverse distance weighted distribution of catch biomass (kg/tow) for Lumpfish.

993

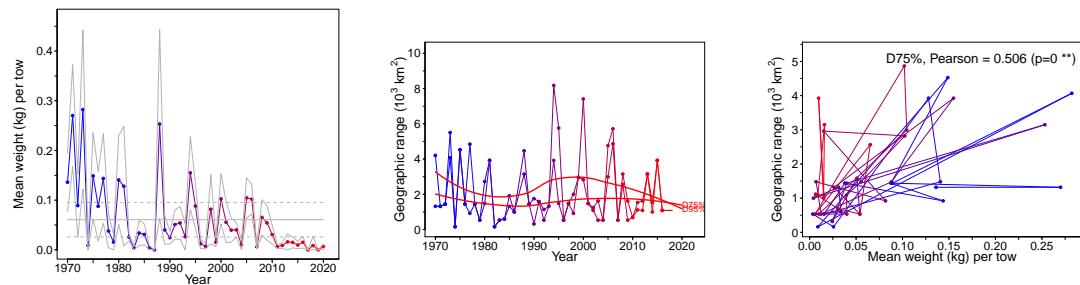


Figure 7.41B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Lumpfish.

994      **7.42 Atlantic spiny lumpsucker (Petite poule de mer atlantique) - species code 502**  
 995      (**category LI**)

996      Scientific name: [Eumicrotremus spinosus](#)

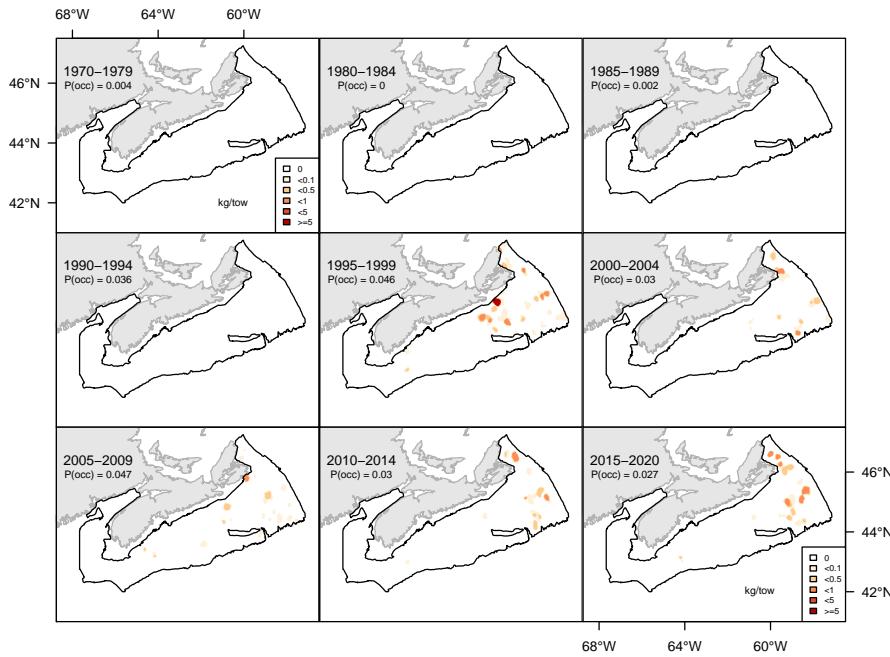


Figure 7.42A. Inverse distance weighted distribution of catch biomass (kg/tow) for Atlantic spiny lumpsucker.

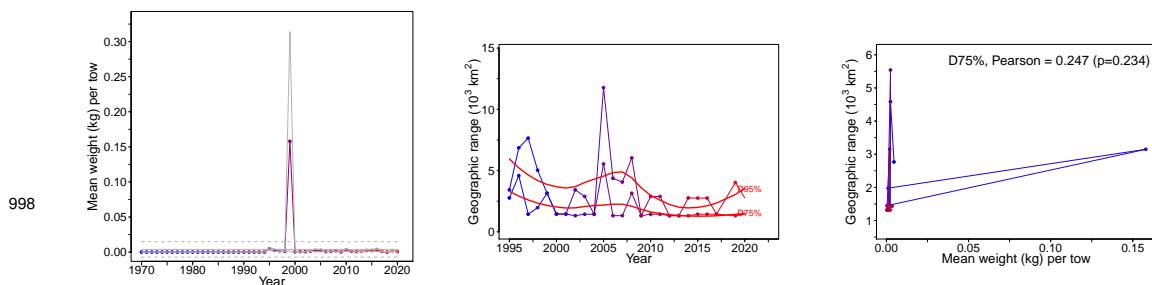


Figure 7.42B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Atlantic spiny lumpsucker.

999

## 7.43 Sand lance (Lançon) - species code 610 (category LI)

1000

Scientific name: [Ammodytes dubius](#)

1001

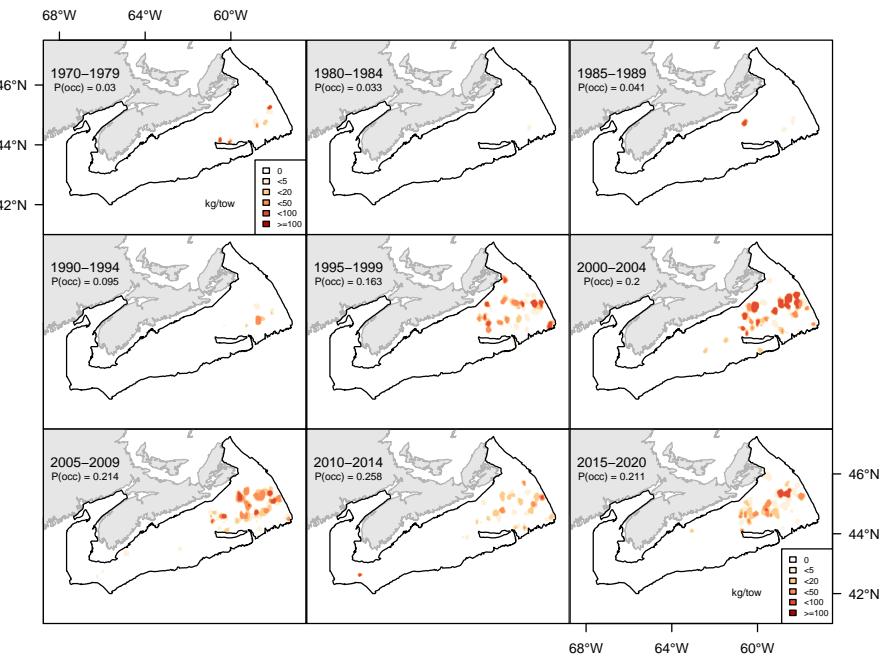


Figure 7.43A. Inverse distance weighted distribution of catch biomass (kg/tow) for Sand lance.

1002

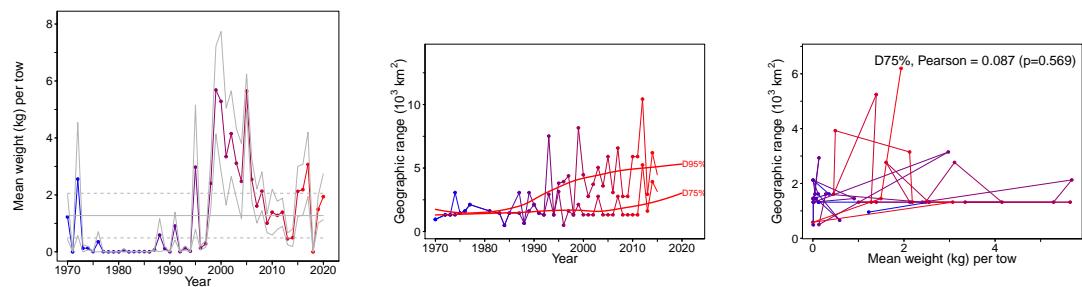


Figure 7.43B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Sand lance.

1003

#### 7.44 Snakeblenny (Lompénie-serpent) - species code 622 (category LI)

1004

Scientific name: [Lumpenus lampretaeformis](#)

1005

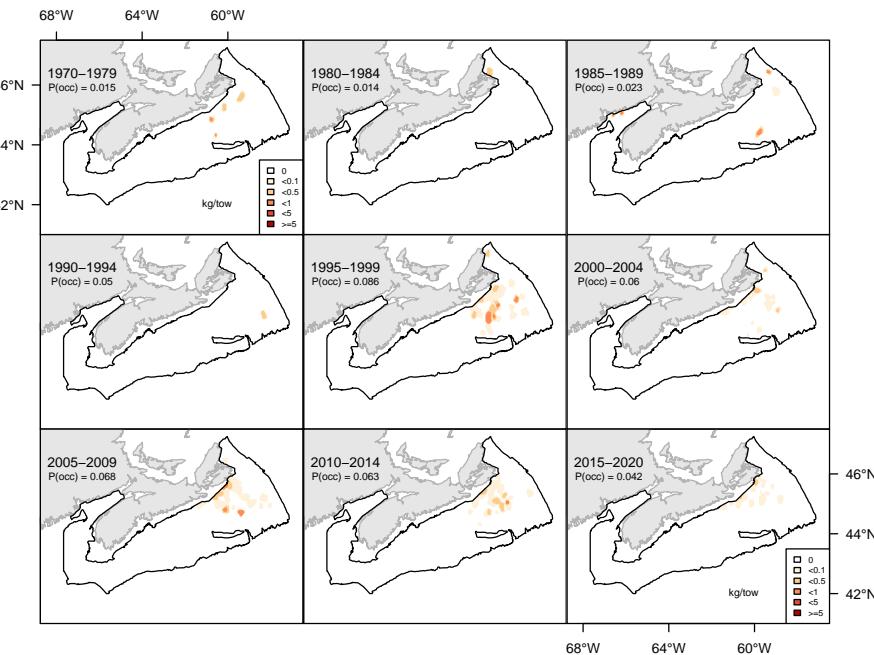


Figure 7.44A. Inverse distance weighted distribution of catch biomass (kg/tow) for Snakeblenny.

1006

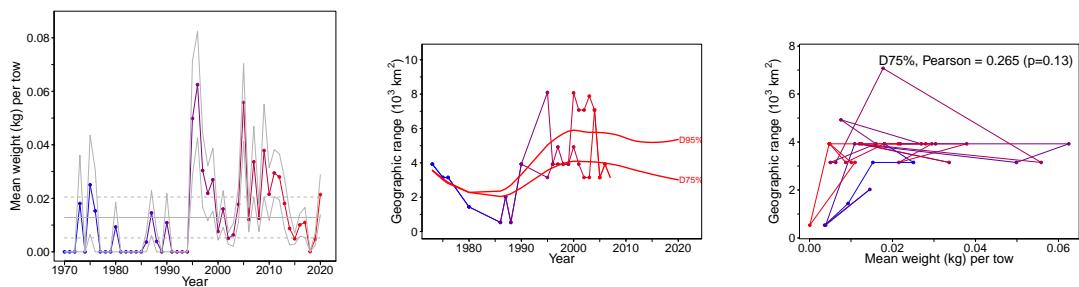


Figure 7.44B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Snakeblenny.

1007

## 7.45 Daubed shanny (Lompénie tachetée) - species code 623 (category LI)

1008

Scientific name: [Leptoclinus maculatus](#)

1009

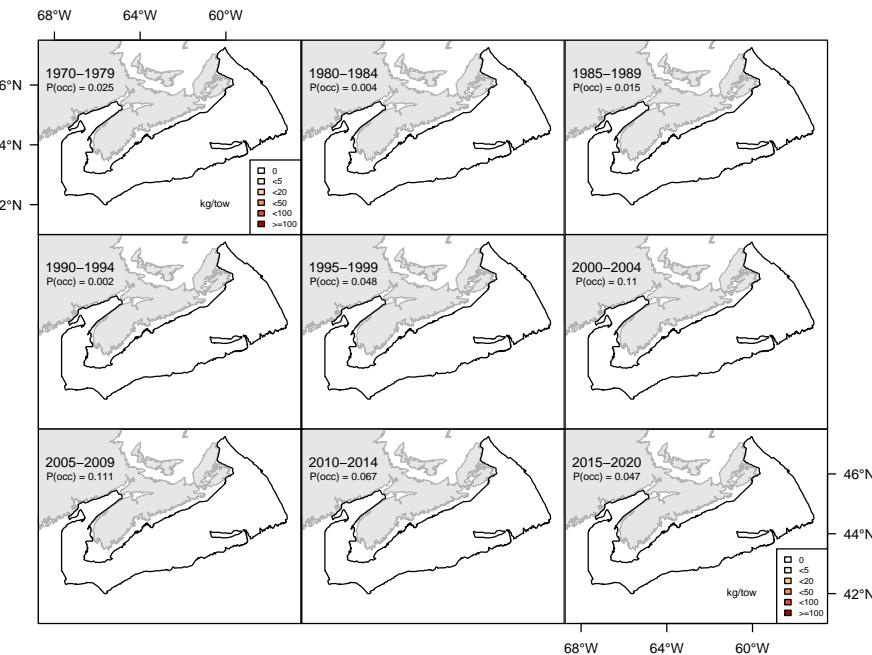


Figure 7.45A. Inverse distance weighted distribution of catch biomass (kg/tow) for Daubed shanny.

1010

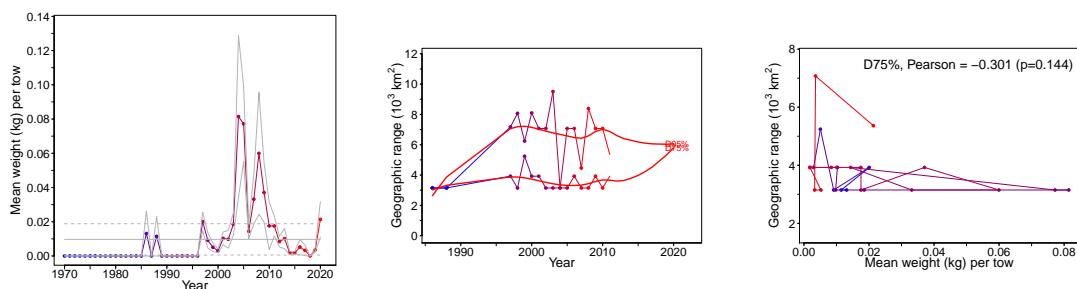


Figure 7.45B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Daubed shanny.

1011

## 7.46 Vahl's eelpout (*Lycodes vahlii*) - species code 647 (category LI)

1012

Scientific name: [Lycodes vahlii](#)

1013

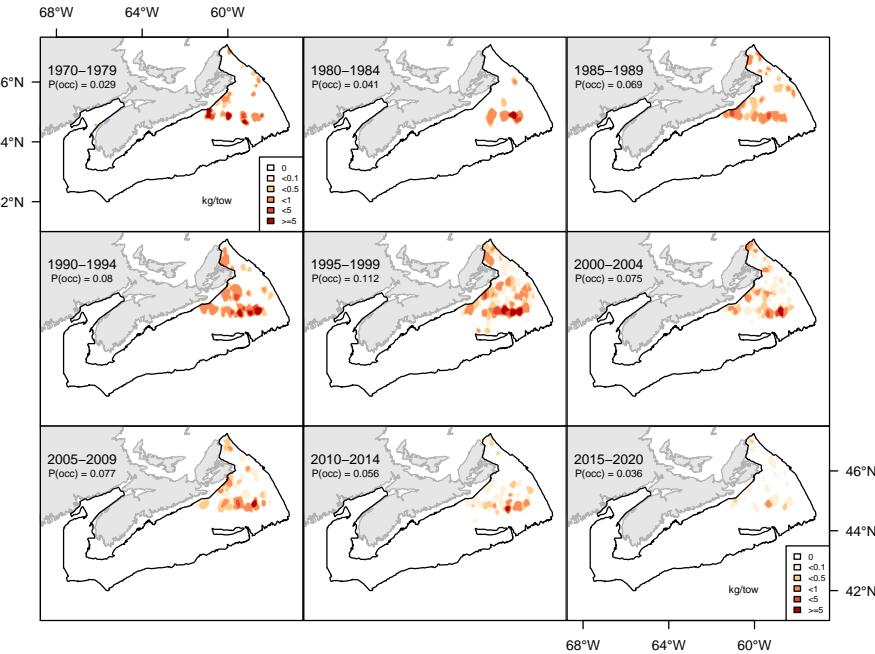


Figure 7.46A. Inverse distance weighted distribution of catch biomass (kg/tow) for Vahl's eelpout.

1014

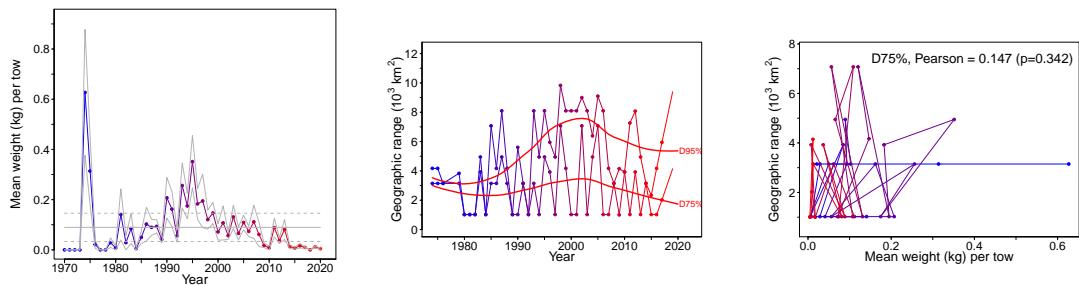


Figure 7.46B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Vahl's eelpout.

1015

## 7.47 Atlantic butterfish (*Stromaté fossette*) - species code 701 (category LI)

1016

Scientific name: [Peprilus triacanthus](#)

1017

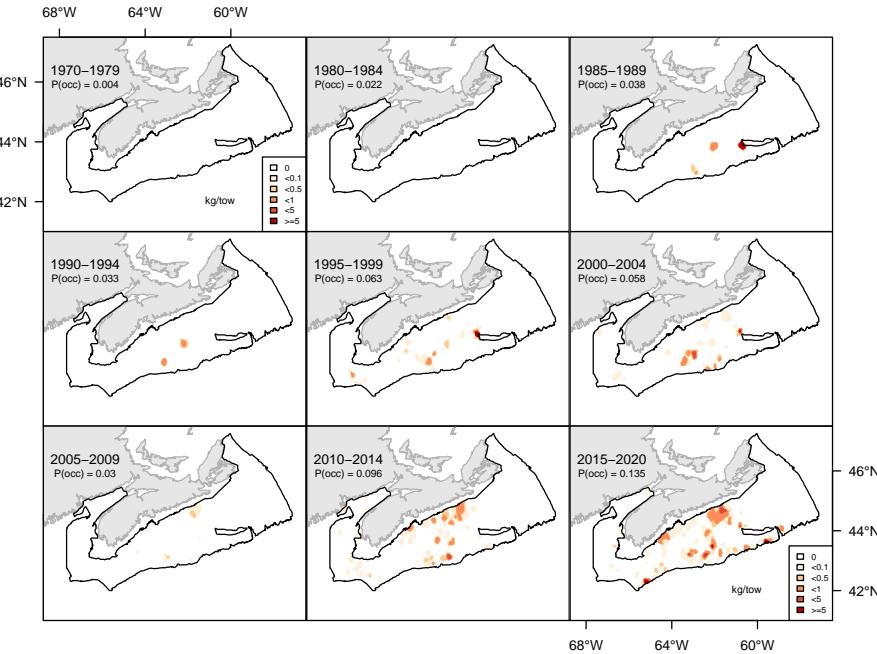


Figure 7.47A. Inverse distance weighted distribution of catch biomass (kg/tow) for Atlantic butterfish.

1018

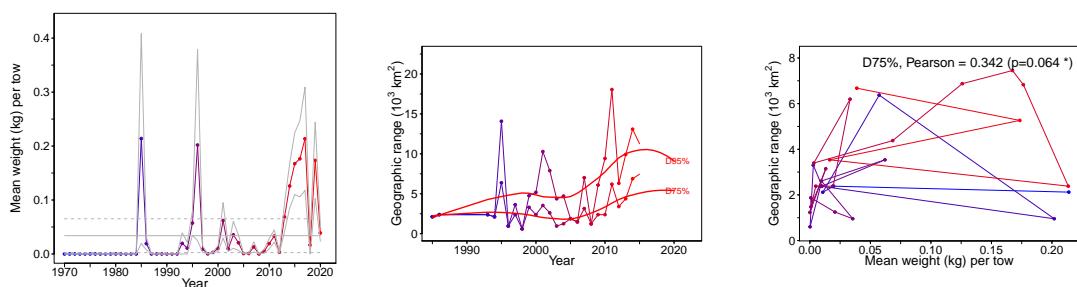


Figure 7.47B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Atlantic butterfish.

1019

## 7.48 Atlantic hookear sculpin (*Hameçon atlantique*) - species code 880 (category LI)

1020

Scientific name: [Artediellus atlanticus](#)

1021

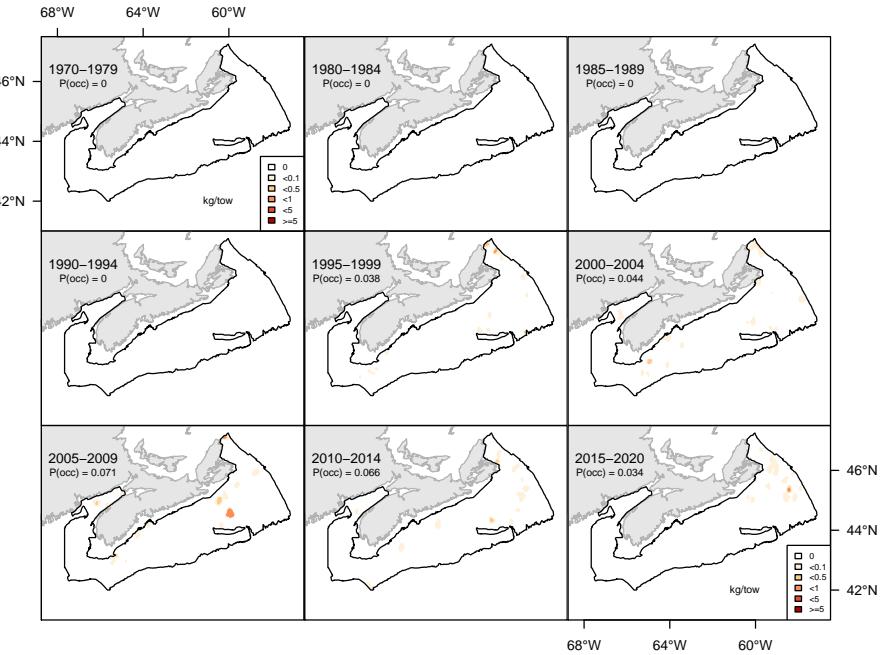


Figure 7.48A. Inverse distance weighted distribution of catch biomass (kg/tow) for Atlantic hookear sculpin.

1022

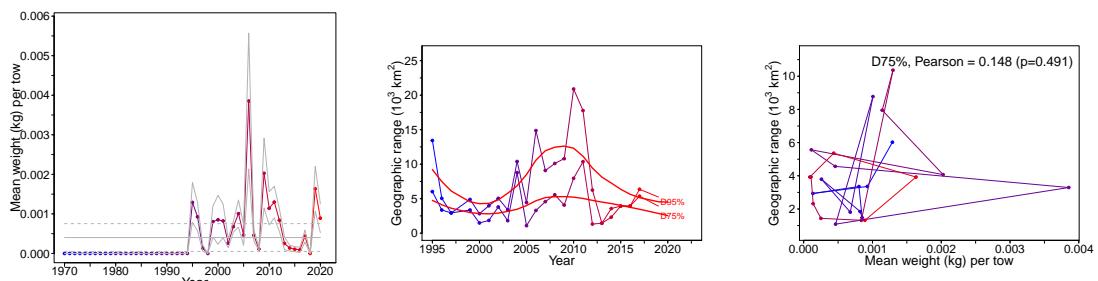


Figure 7.48B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Atlantic hookear sculpin.

1023

## 7.49 Barndoor skate (Grande raie) - species code 200 (category LI)

1024

Scientific name: [Dipturus laevis](#)

1025

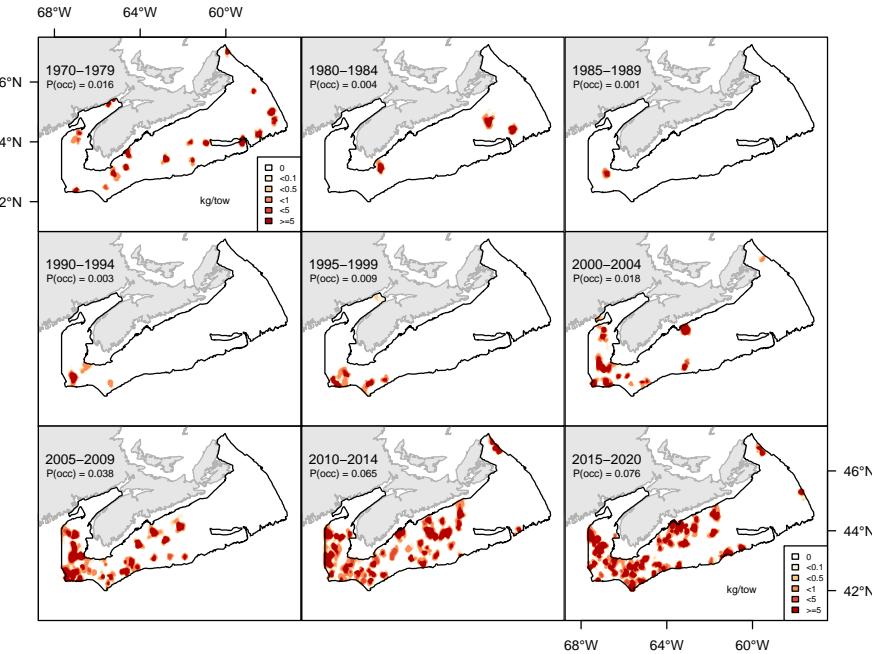


Figure 7.49A. Inverse distance weighted distribution of catch biomass (kg/tow) for Barndoor skate.

1026

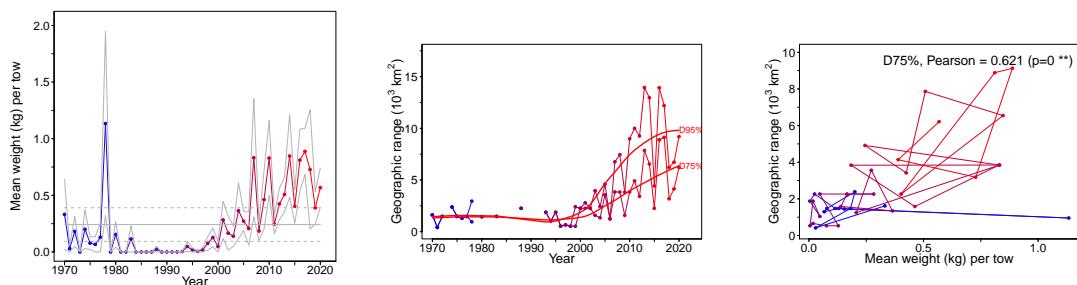


Figure 7.49B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Barndoor skate.

1027

## 7.50 Little skate (Raie hérisson) - species code 203 (category LI)

1028

Scientific name: [Leucoraja erinacea](#)

1029

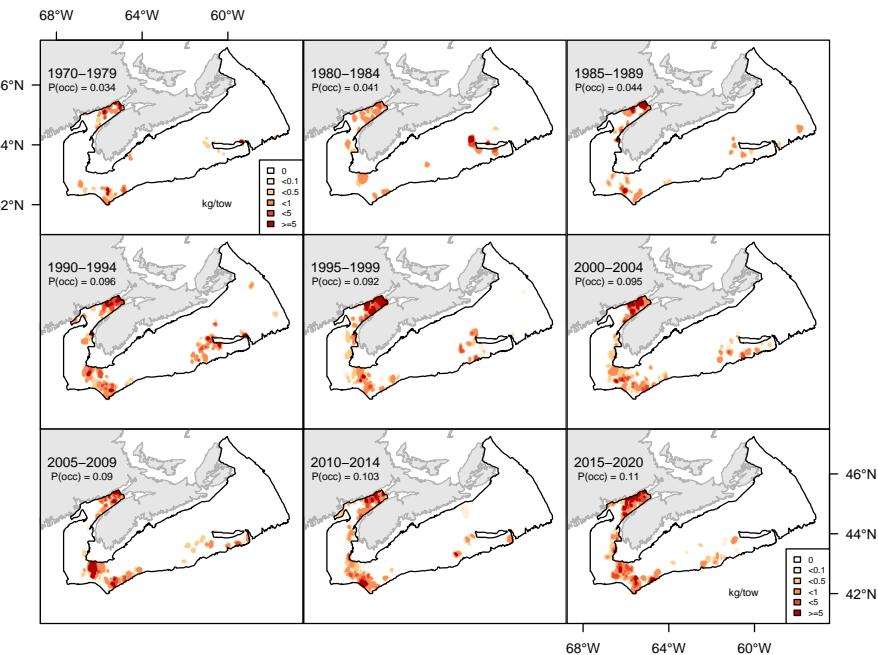


Figure 7.50A. Inverse distance weighted distribution of catch biomass (kg/tow) for Little skate.

1030

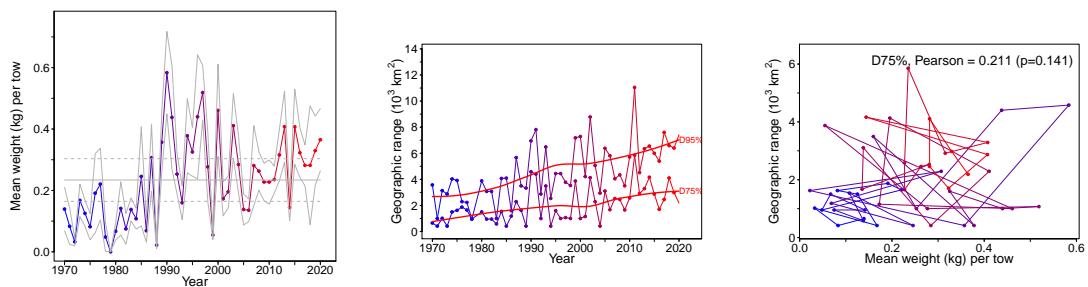


Figure 7.50B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Little skate.

1031

## 7.51 Northern prawn (Crevette nordique) - species code 2211 (category SF)

1032

Scientific name: [Pandalus borealis](#)

1033

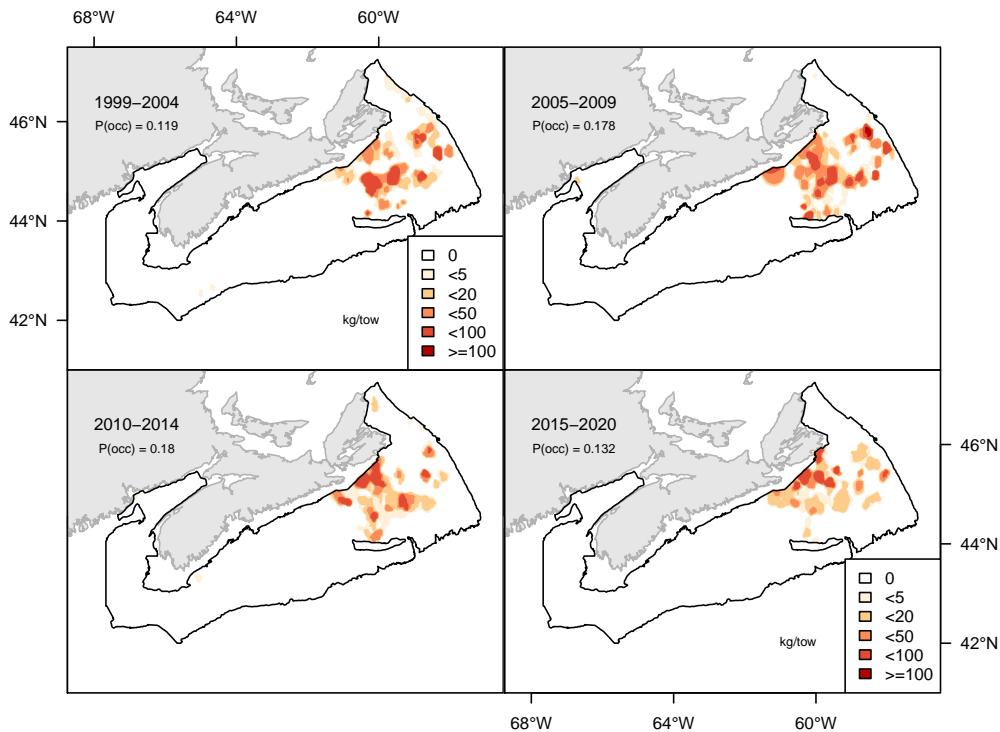


Figure 7.51A. Inverse distance weighted distribution of catch biomass (kg/tow) for Northern prawn.

1034

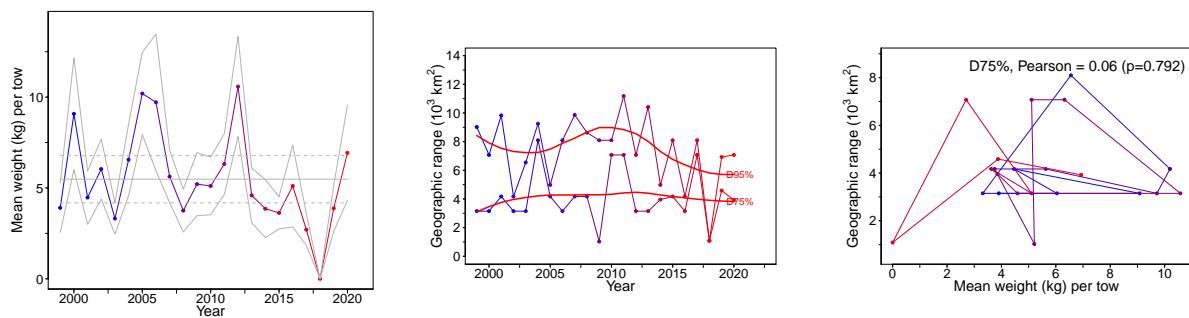


Figure 7.51B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Northern prawn.

1035

## 7.52 Jonah crab (*Tourteau jona*) - species code 2511 (category SF)

1036

Scientific name: [Cancer borealis](#)

1037

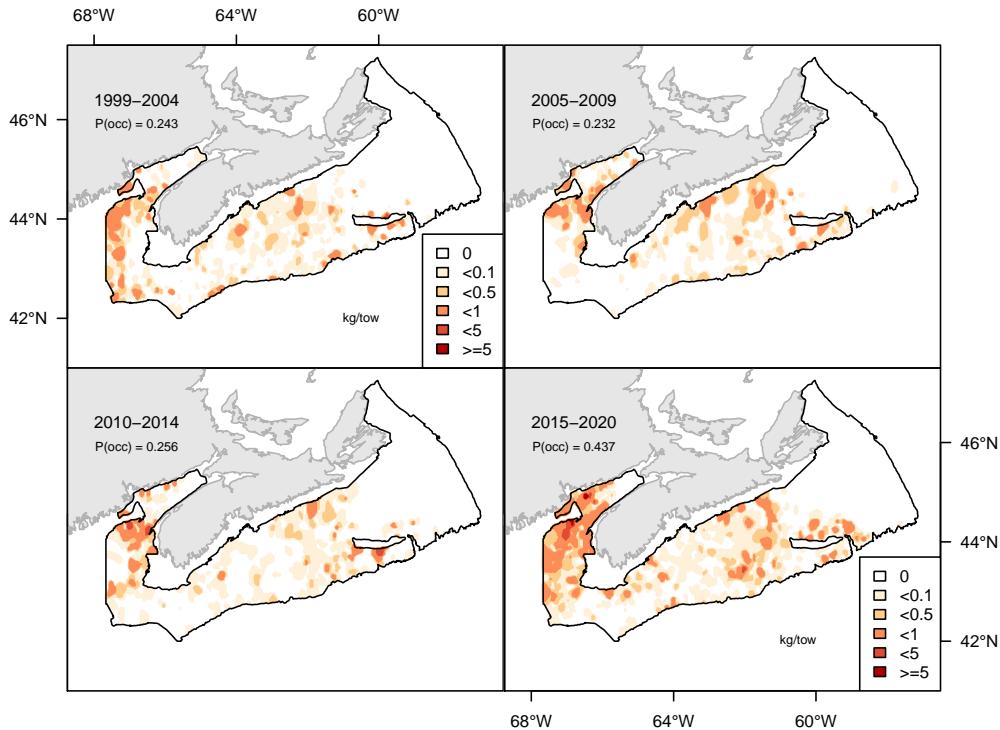


Figure 7.52A. Inverse distance weighted distribution of catch biomass (kg/tow) for Jonah crab.

1038

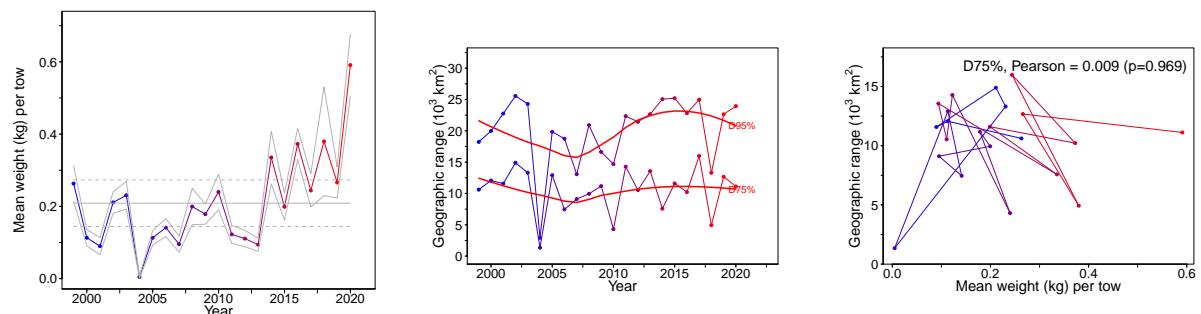


Figure 7.52B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Jonah crab.

1039

### 7.53 Atlantic rock crab (Tourteau poïnclos) - species code 2513 (category SF)

1040

Scientific name: [Cancer irroratus](#)

1041

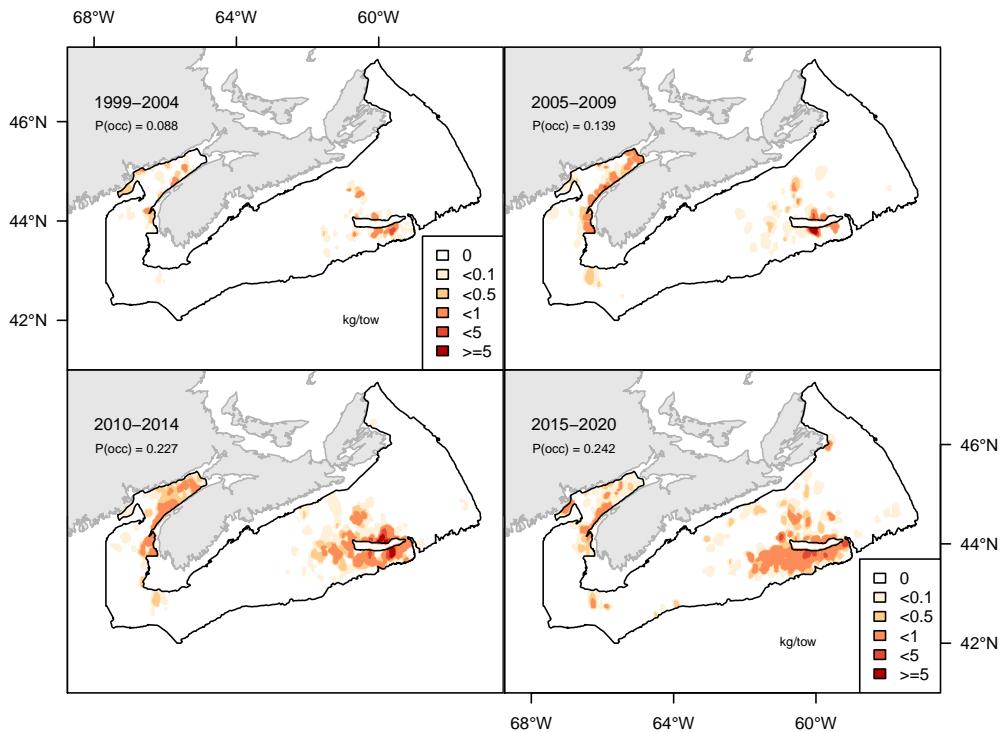


Figure 7.53A. Inverse distance weighted distribution of catch biomass (kg/tow) for Atlantic rock crab.

1042

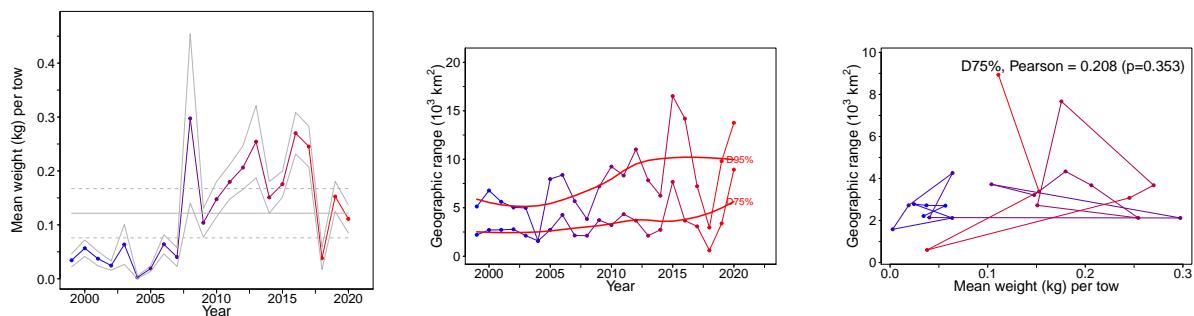


Figure 7.53B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Atlantic rock crab.

1043

## 7.54 Arctic lyre crab (*Crabe Hyas coarctatus*) - species code 2521 (category SF)

1044

Scientific name: [Hyas coarctatus](#)

1045

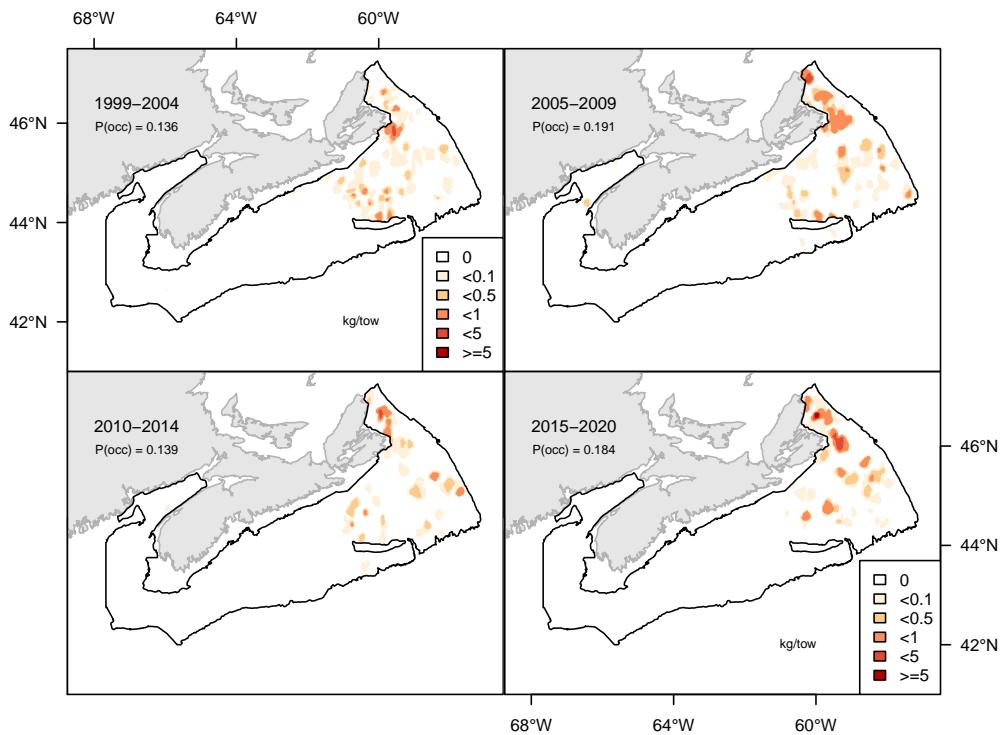


Figure 7.54A. Inverse distance weighted distribution of catch biomass (kg/tow) for Arctic lyre crab.

1046

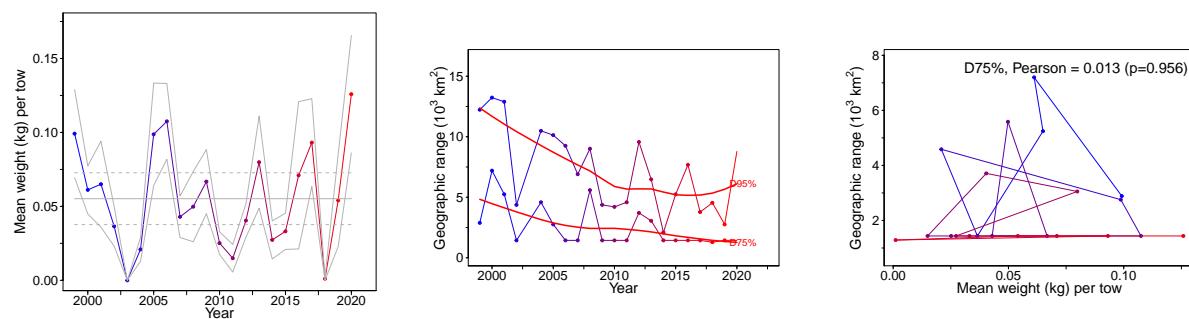


Figure 7.54B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Arctic lyre crab.

1047

## 7.55 Atlantic king crab (Crabe épineux du nord) - species code 2523 (category SF)

1048

Scientific name: [Lithodes maja](#)

1049

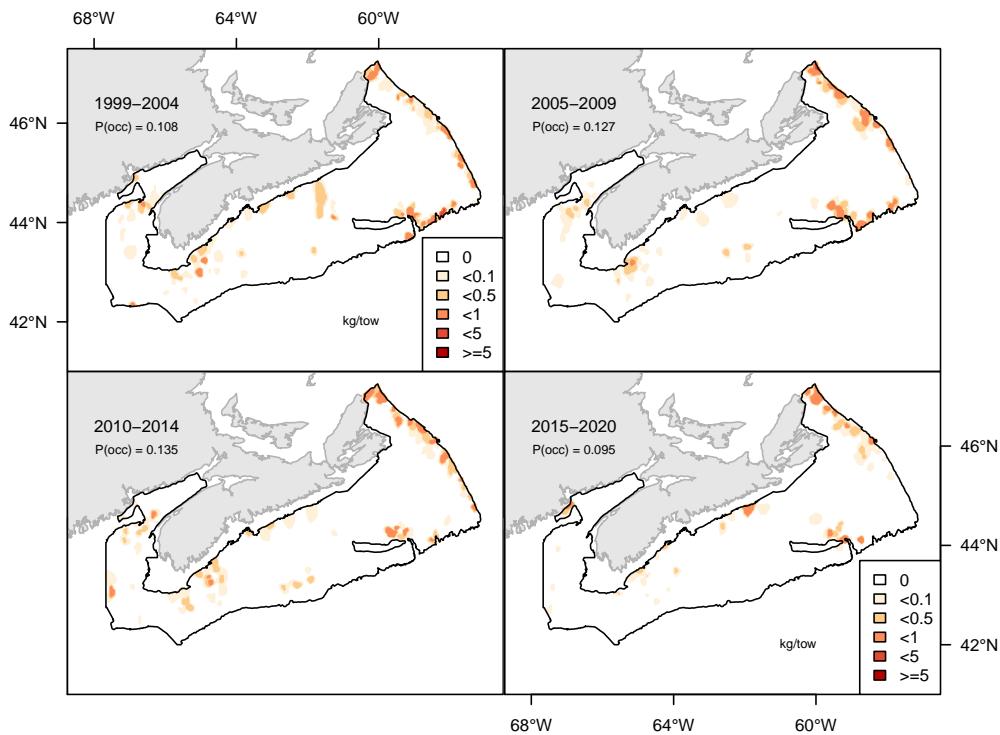


Figure 7.55A. Inverse distance weighted distribution of catch biomass (kg/tow) for Atlantic king crab.

1050

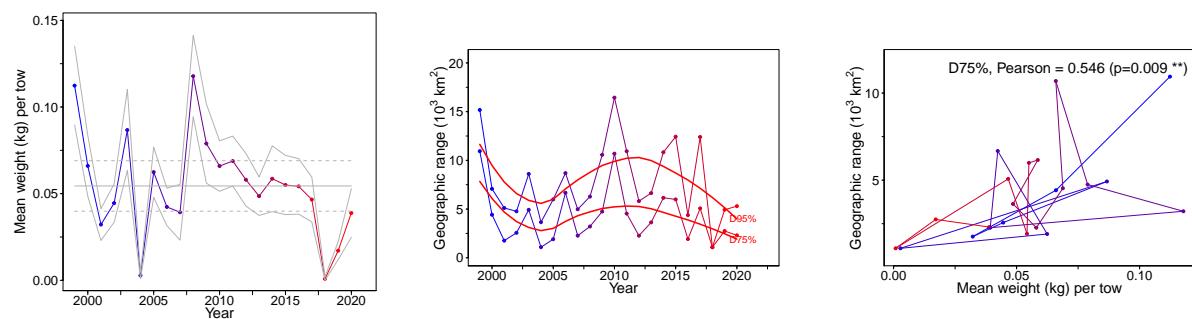


Figure 7.55B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Atlantic king crab.

1051

## 7.56 Queen crab (Crabe des neiges) - species code 2526 (category SF)

1052

Scientific name: [Chionoecetes opilio](#)

1053

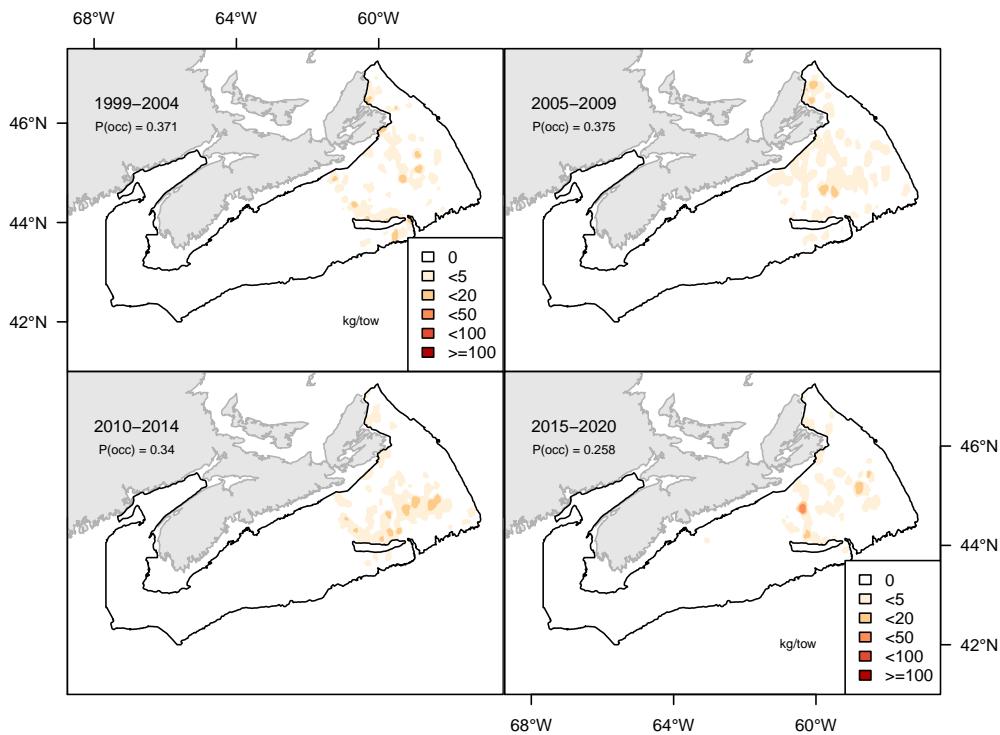


Figure 7.56A. Inverse distance weighted distribution of catch biomass (kg/tow) for Queen crab.

1054

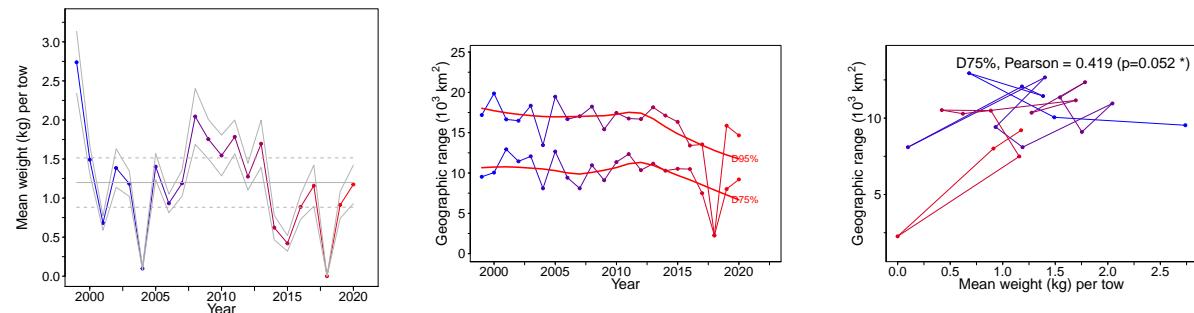


Figure 7.56B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Queen crab.

1055

### 7.57 Great spider crab (Crabe lyre araignée) - species code 2527 (category SF)

1056

Scientific name: [Hyas araneus](#)

1057

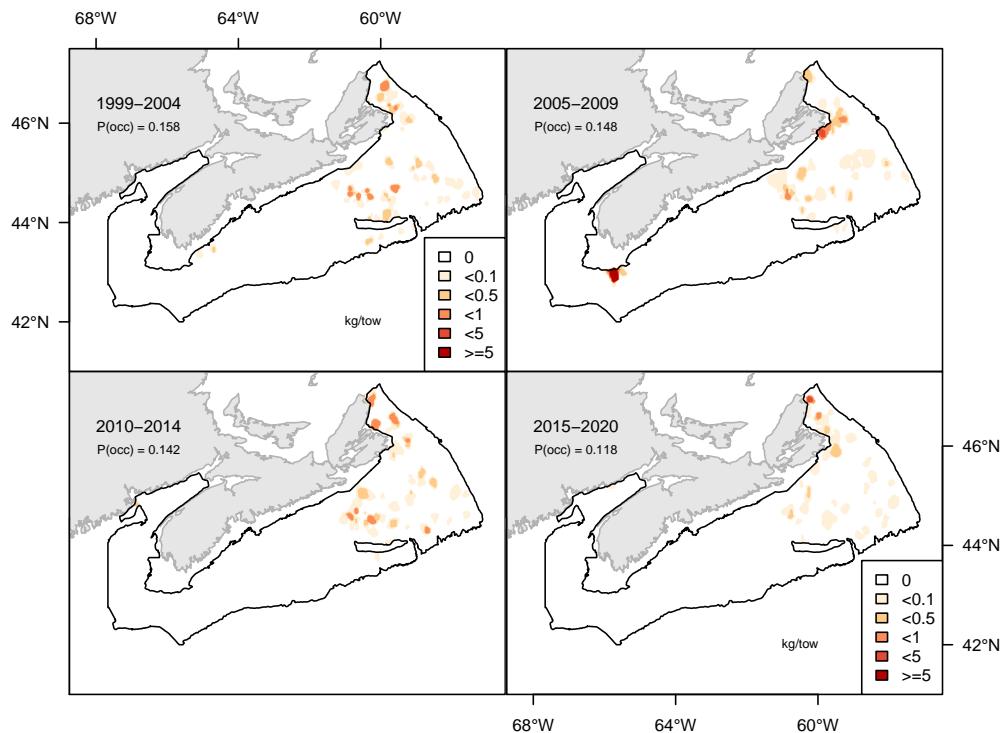


Figure 7.57A. Inverse distance weighted distribution of catch biomass (kg/tow) for Great spider crab.

1058

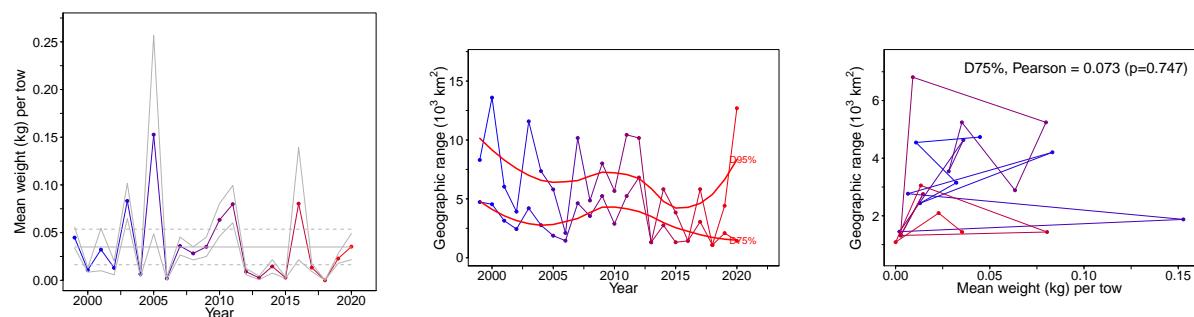


Figure 7.57B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of Great spider crab.

1059

## 7.58 American lobster (Homard américain) - species code 2550 (category SF)

1060

Scientific name: [Homarus americanus](#)

1061

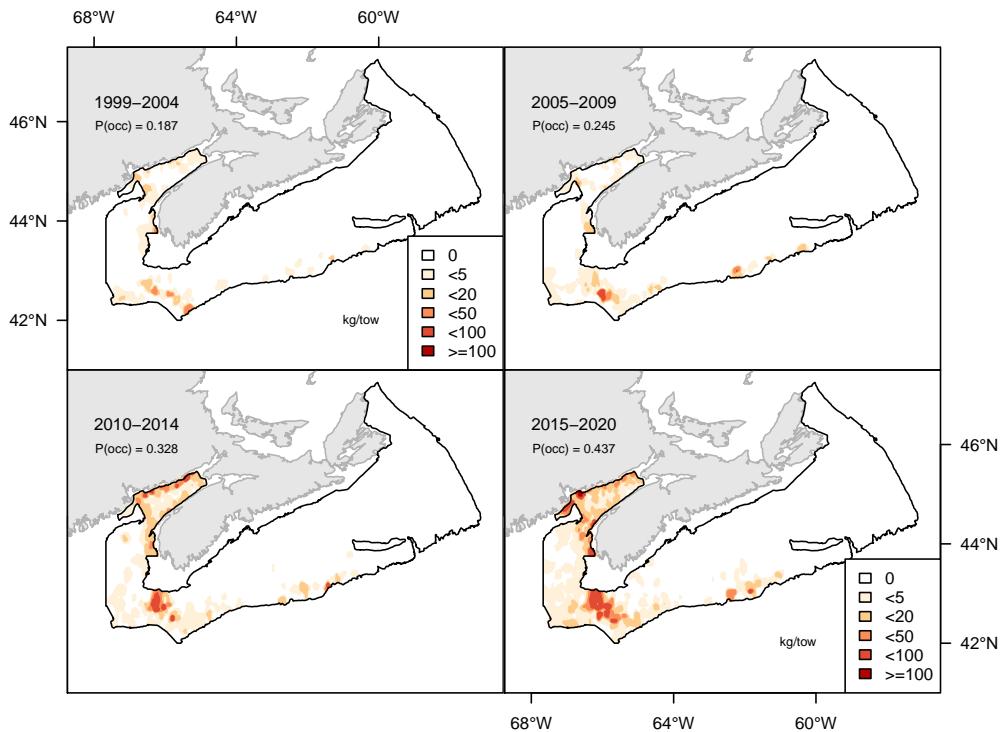


Figure 7.58A. Inverse distance weighted distribution of catch biomass (kg/tow) for American lobster.

1062

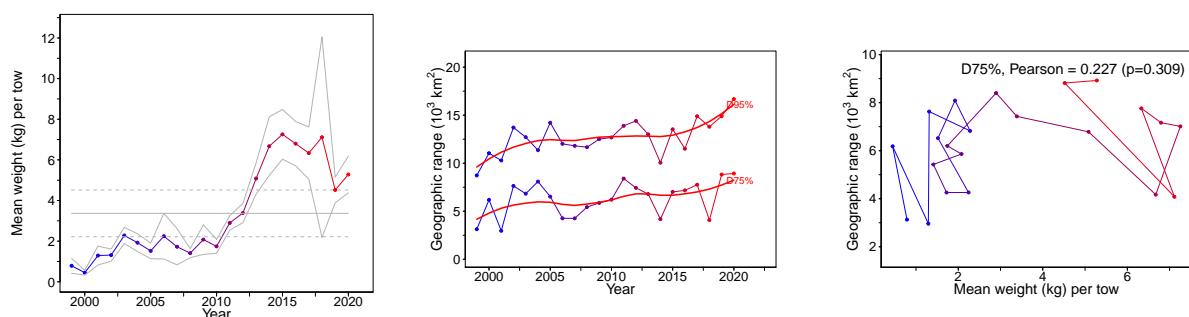
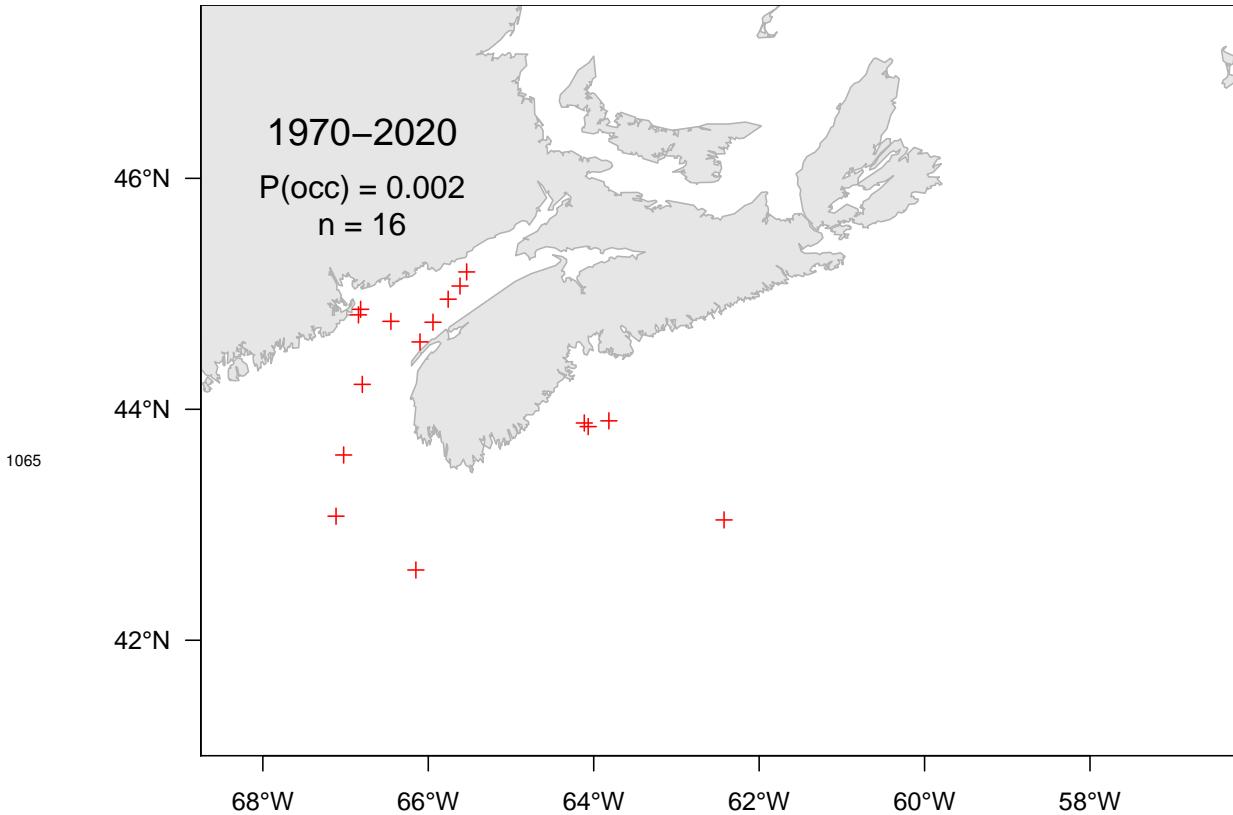


Figure 7.58B. Stratified random estimates of biomass (kg/tow), D75 and D95 and the correlation between D75 and biomass of American lobster.

1063      **7.59 Sea lamprey (*Lamproie marine*) - species code 240 (category LR)**

1064      Scientific name: [Petromyzon marinus](#)



1066

## 7.60 Atlantic tomcod (*Poulamon atlantique*) - species code 17 (category LR)

1067

Scientific name: [Micogadus tomcod](#)

1068

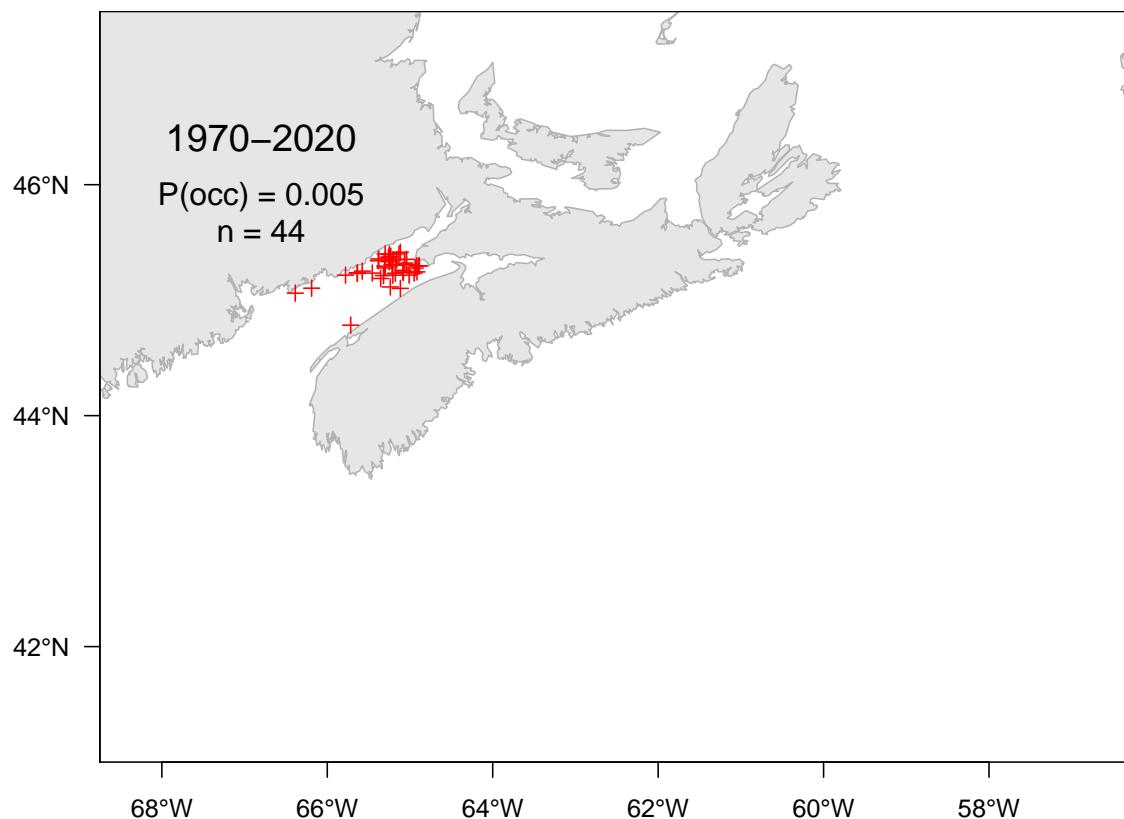


Figure 7.60A. Catch distribution for Atlantic tomcod.

1069

## 7.61 Offshore silver hake (Merlu argenté du large) - species code 19 (category LR)

1070

Scientific name: [Merluccius albidus](#)

1071

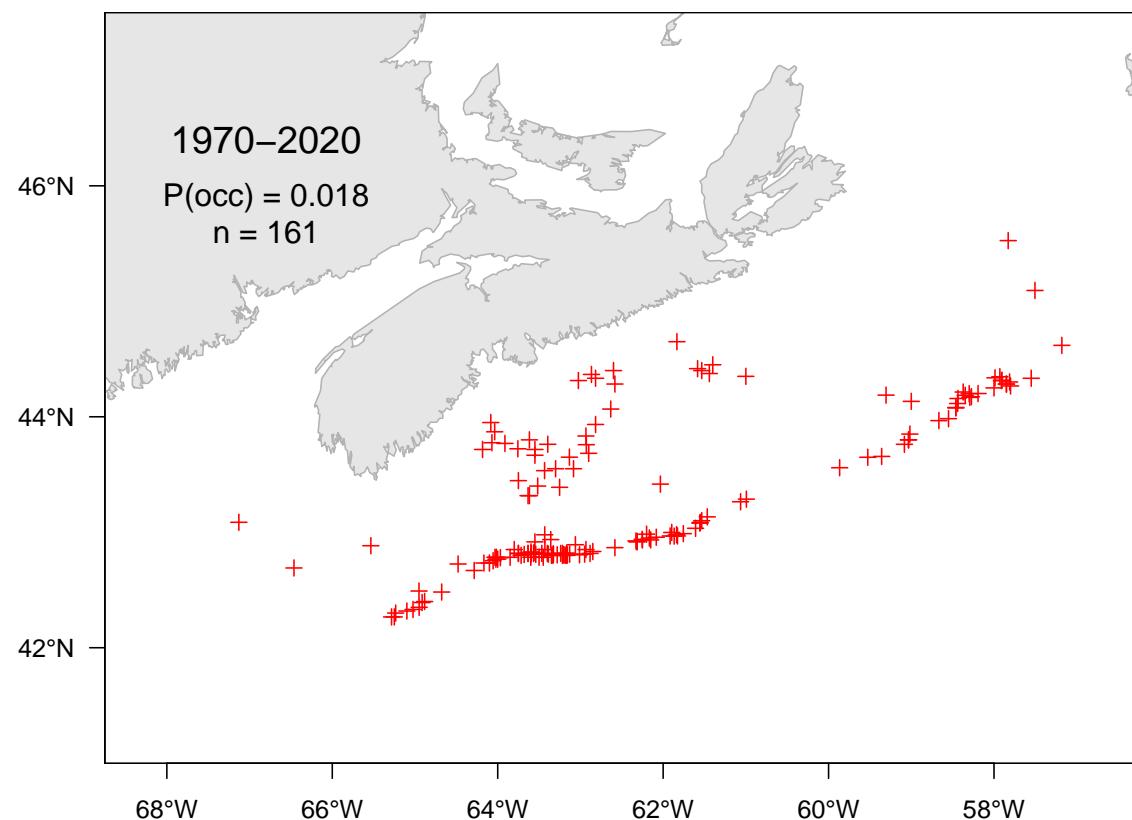


Figure 7.61A. Catch distribution for Offshore silver hake.

1072

## 7.62 Spotted wolffish (*Loup tacheté*) - species code 51 (category LR)

1073

Scientific name: [Anarhichas minor](#)

1074

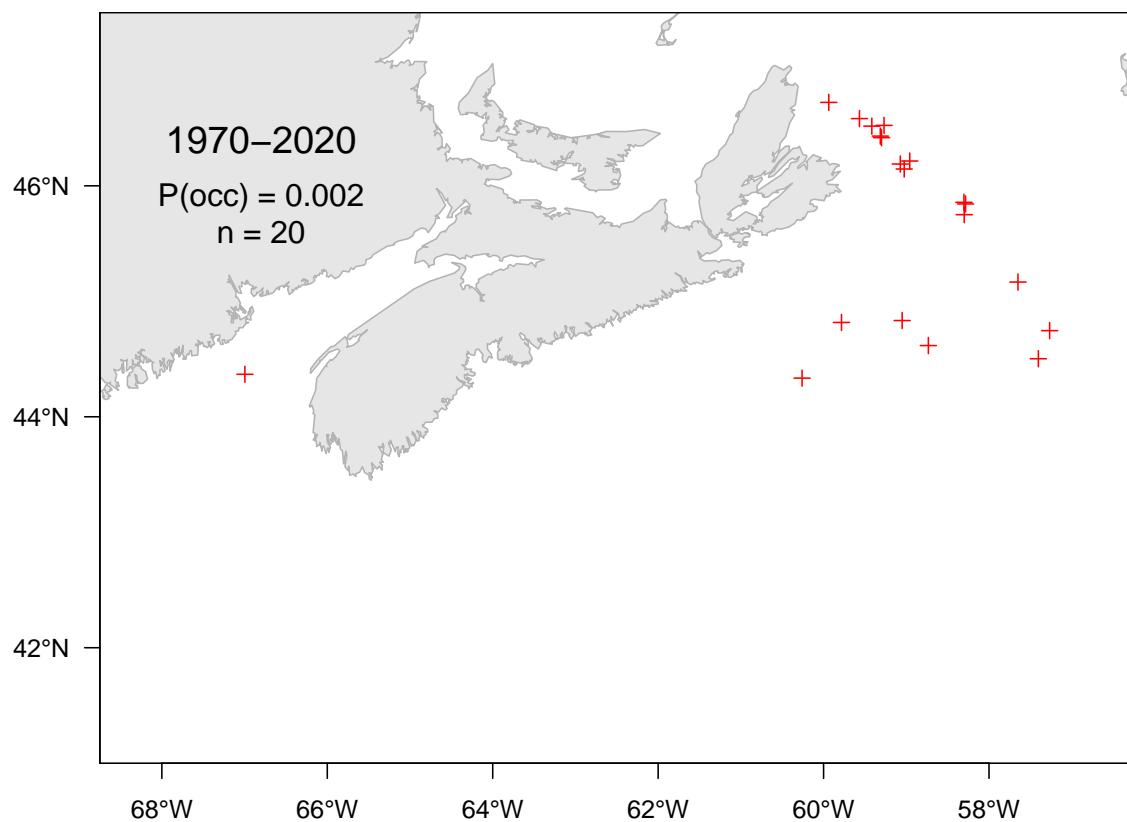


Figure 7.62A. Catch distribution for Spotted wolffish.

1075

### 7.63 Northern wolffish (Loup à tête large) - species code 52 (category LR)

1076

Scientific name: [Anarhichas denticulatus](#)

1077

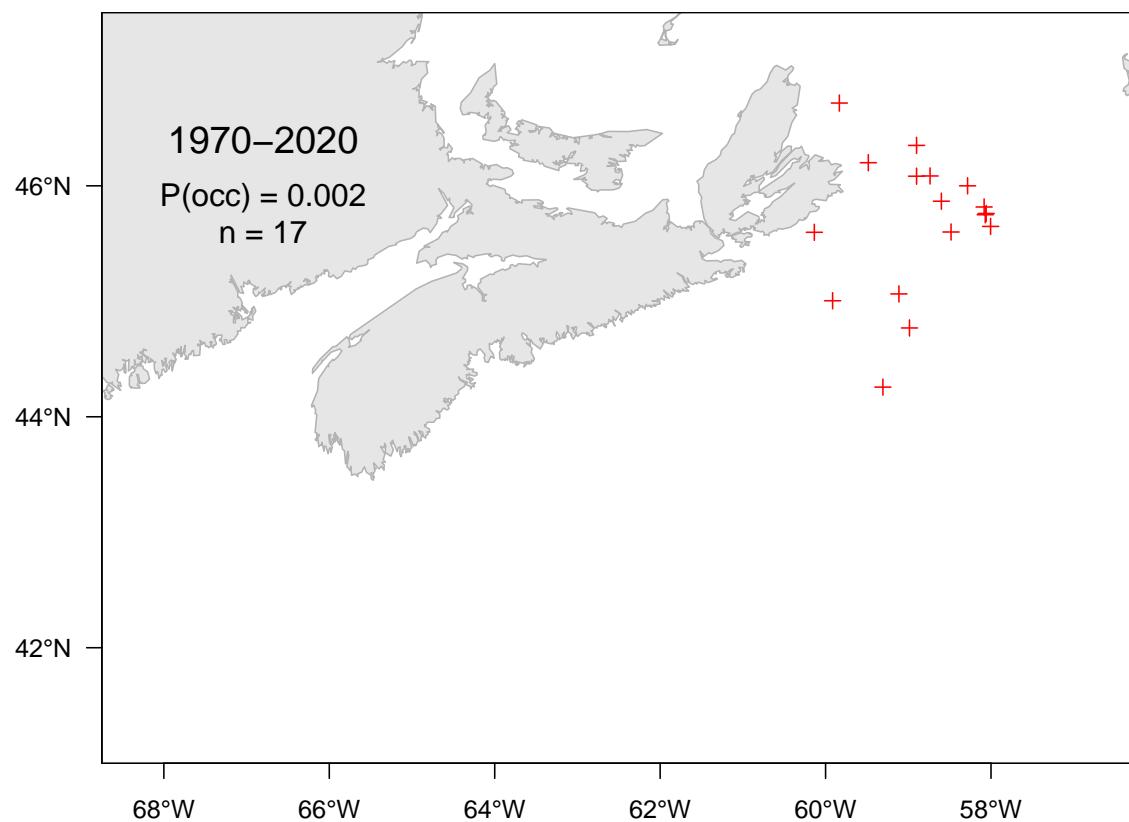


Figure 7.63A. Catch distribution for Northern wolffish.

1078

## 7.64 Rainbow smelt (Éperlan arc-en-ciel) - species code 63 (category LR)

1079

Scientific name: [Osmerus mordax](#)

1080

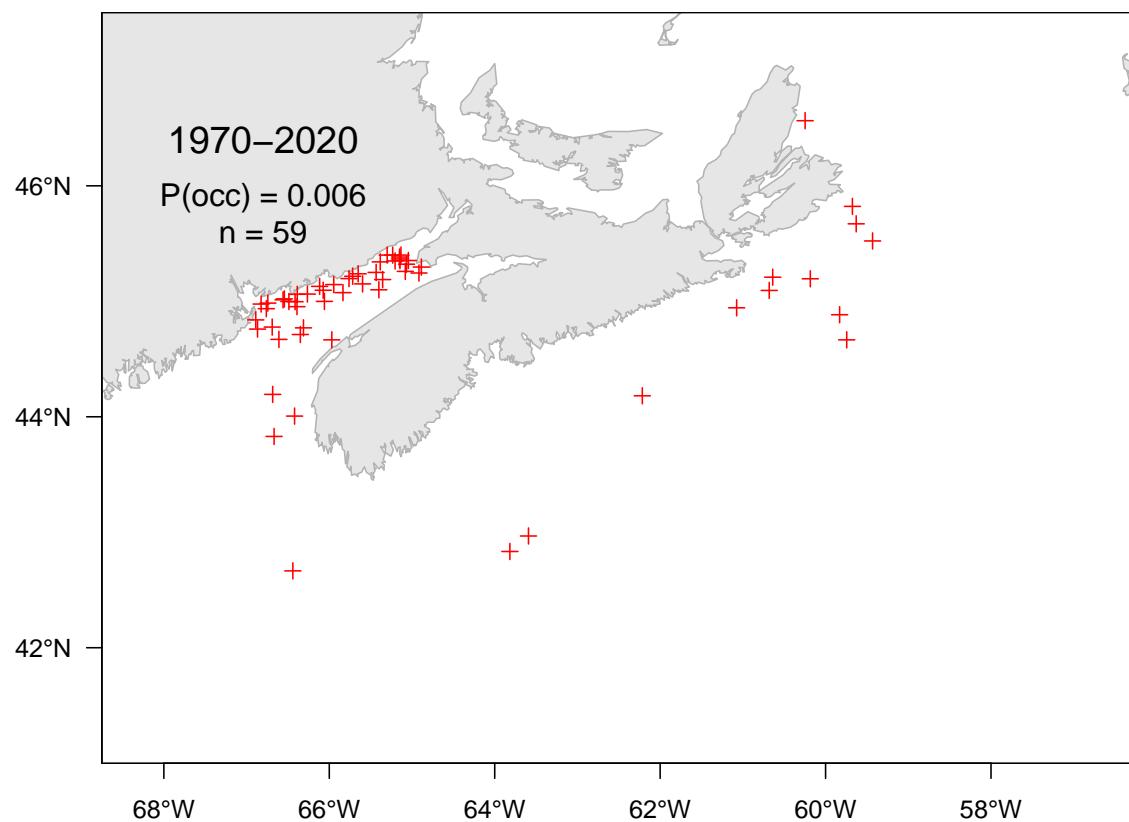


Figure 7.64A. Catch distribution for Rainbow smelt.

1081

## 7.65 Cunner (Tanche-tautogue) - species code 122 (category LR)

1082

Scientific name: [Tautogolabrus adspersus](#)

1083

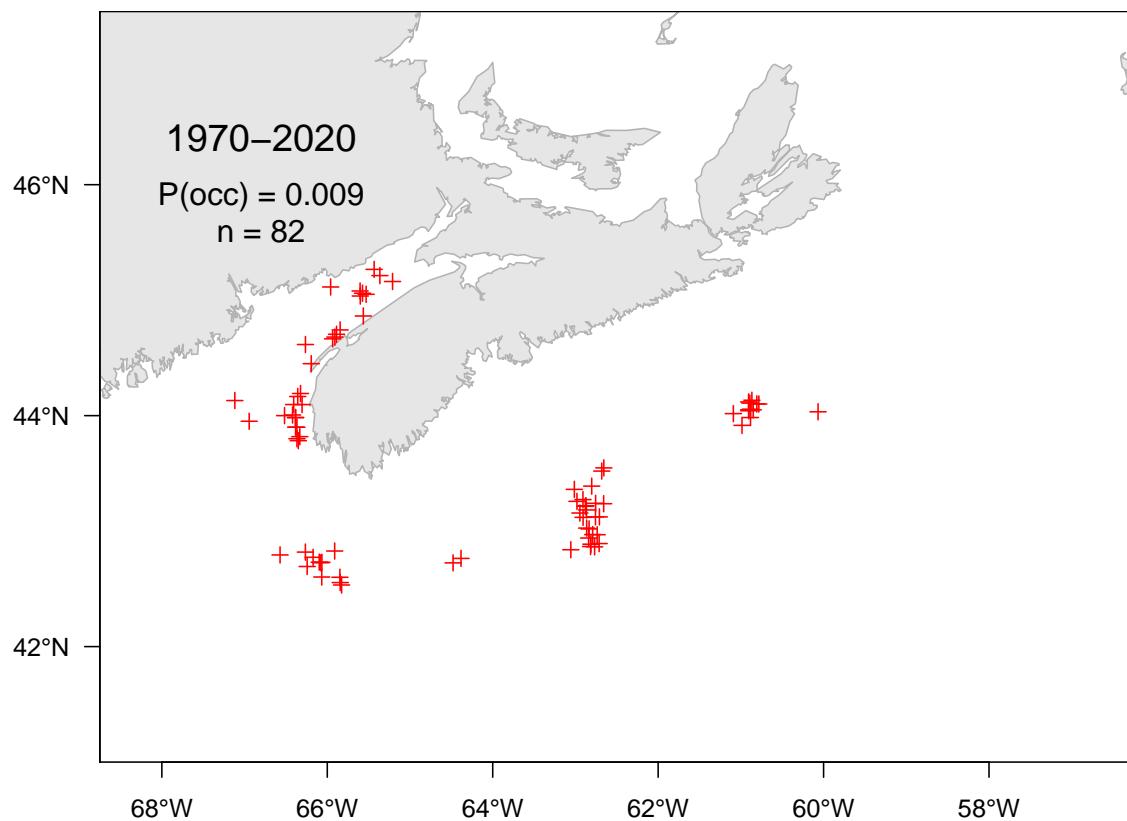


Figure 7.65A. Catch distribution for Cunner.

1084

## 7.66 Fourspot flounder (Cardeau à quatre ocelles) - species code 142 (category LR)

1085

Scientific name: [Hippoglossina oblonga](#)

1086

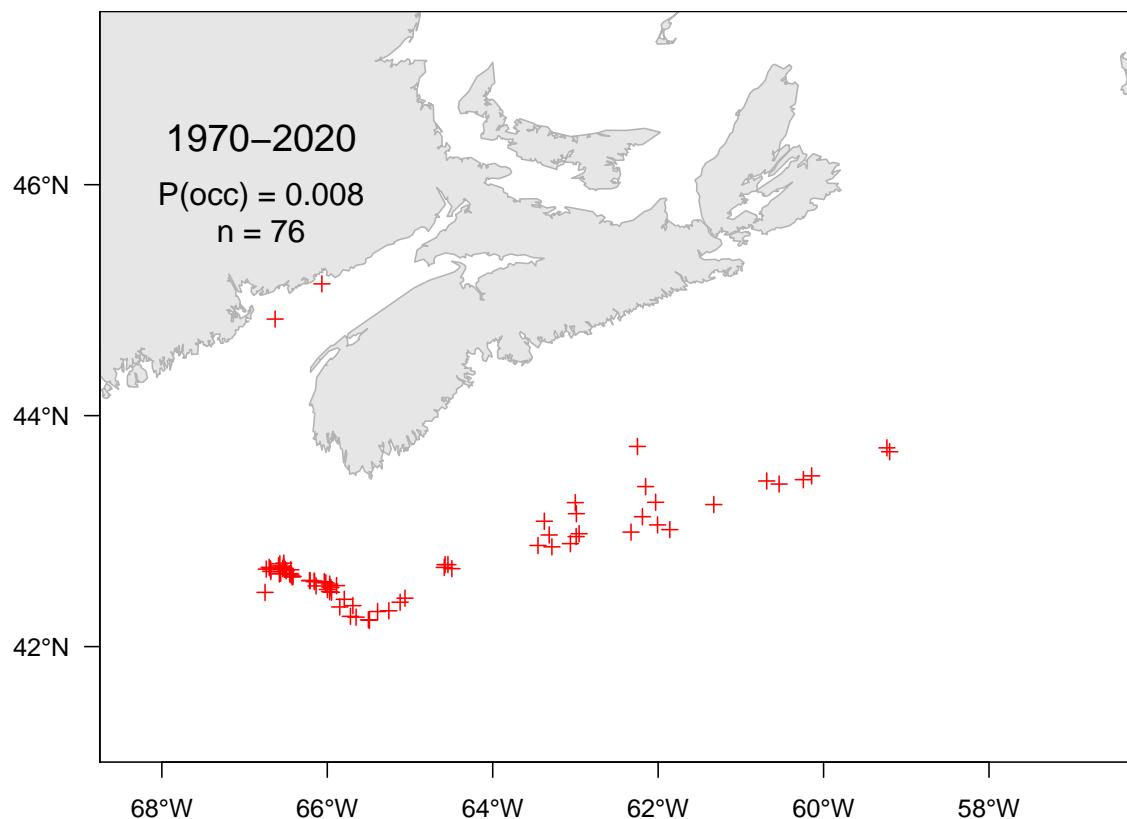


Figure 7.66A. Catch distribution for Fourspot flounder.

1087

## 7.67 Windowpane flounder (Turbot de sable) - species code 143 (category LR)

1088

Scientific name: [Scophthalmus aquosus](#)

1089

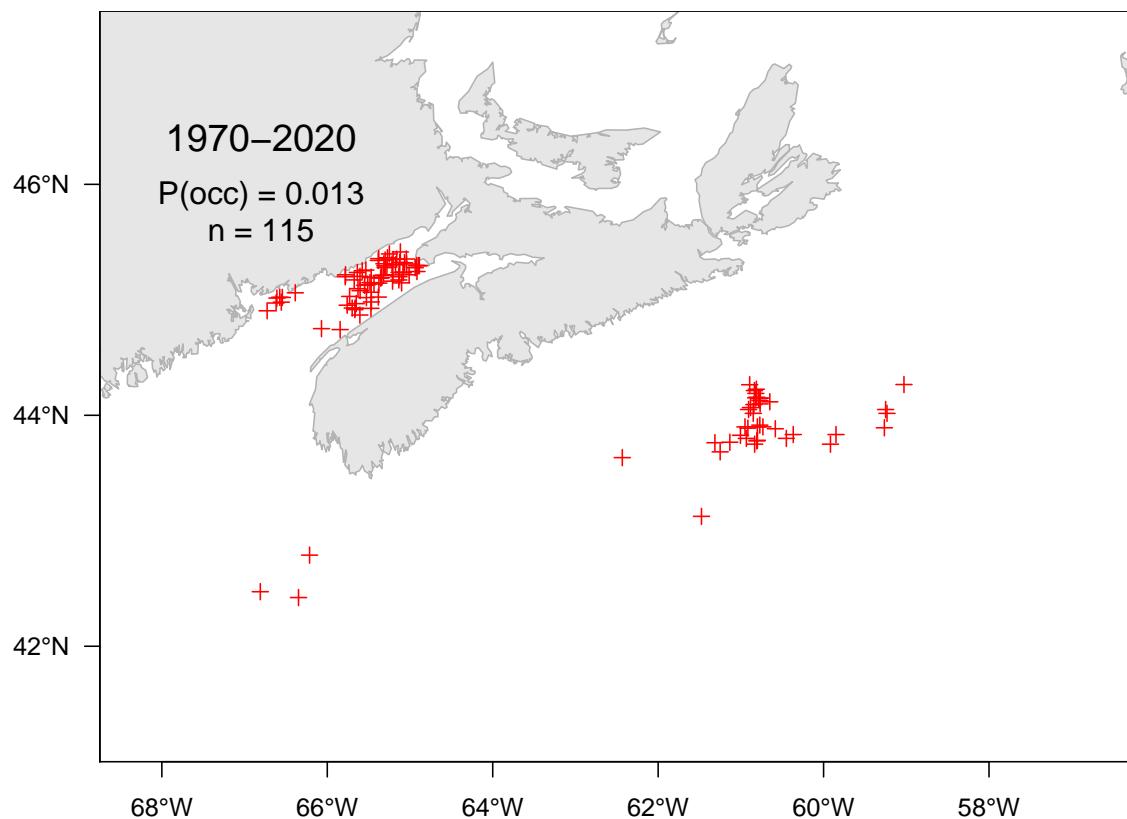


Figure 7.67A. Catch distribution for Windowpane flounder.

1090

## 7.68 Longnose greeneye (Oeil-vert à long nez) - species code 149 (category LR)

1091

Scientific name: [Parasudis triculenta](#)

1092

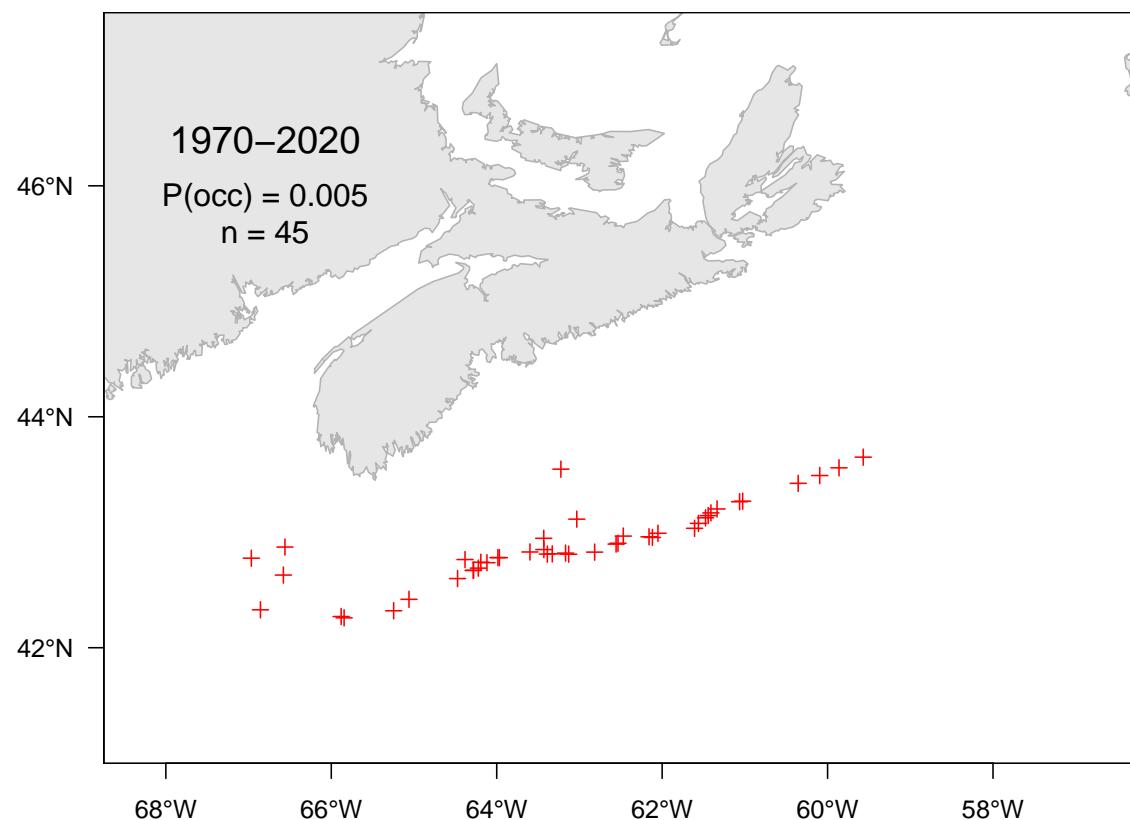


Figure 7.68A. Catch distribution for Longnose greeneye.

1093

### 7.69 Lanternfishes (Poissons-lanternes) - species code 150 (category LR)

1094

Scientific name: [Myctophidae](#)

1095

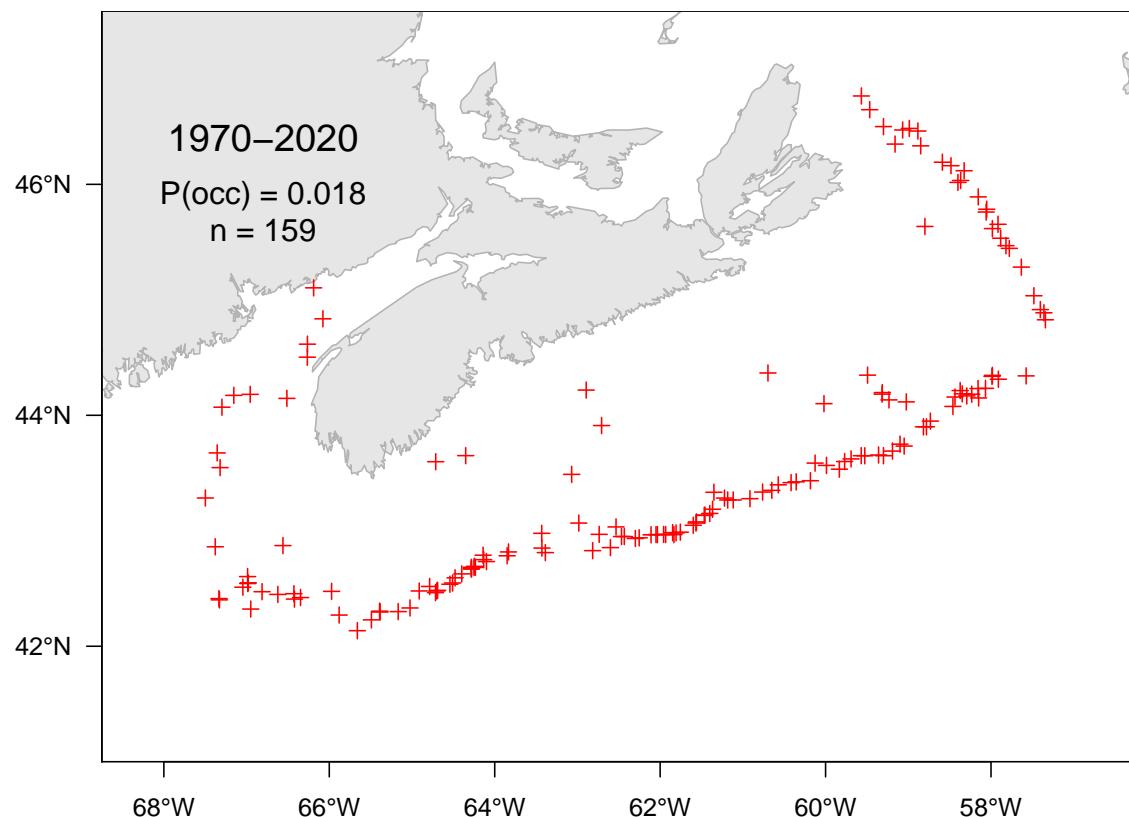


Figure 7.69A. Catch distribution for Lanternfishes.

1096

## 7.70 Shortnose greeneye (Éperlan du large) - species code 156 (category LR)

1097

Scientific name: [Chlorophthalmus agassizi](#)

1098

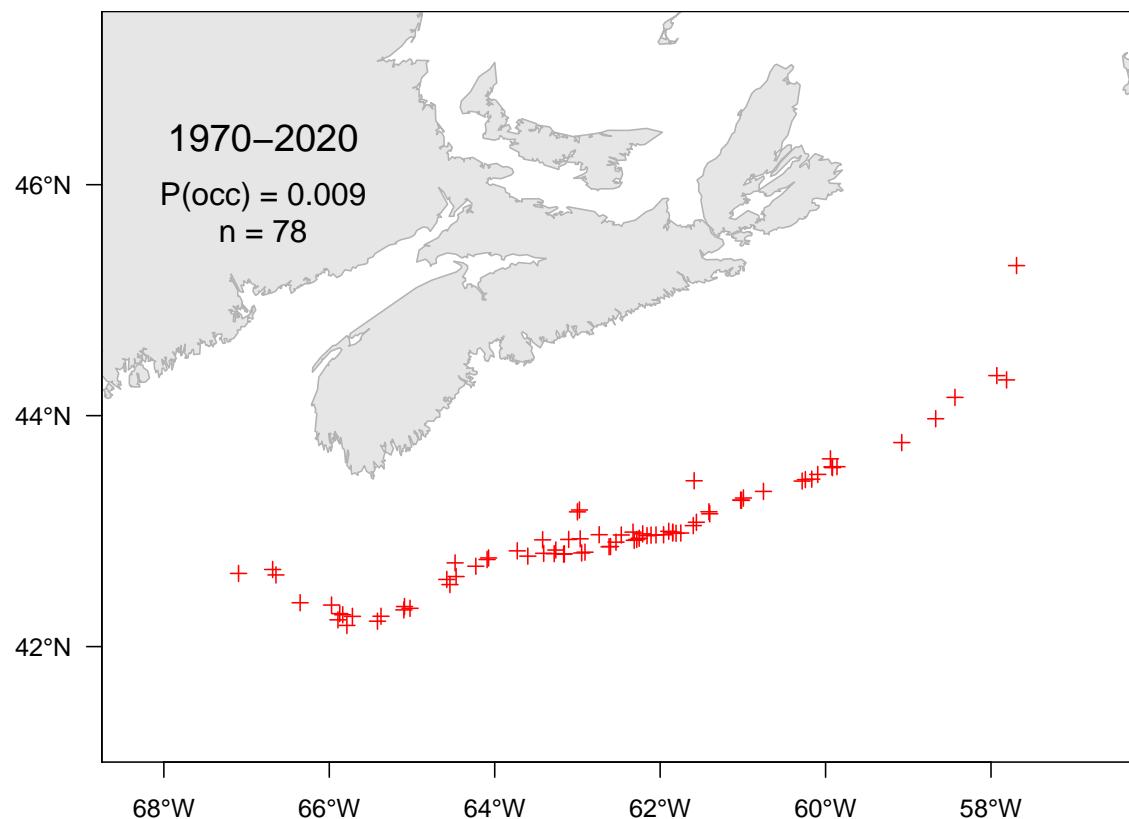


Figure 7.70A. Catch distribution for Shortnose greeneye.

1099

## 7.71 Silvery lightfish (Brossé améthyste) - species code 158 (category LR)

1100

Scientific name: [Maurolicus muelleri](#)

1101

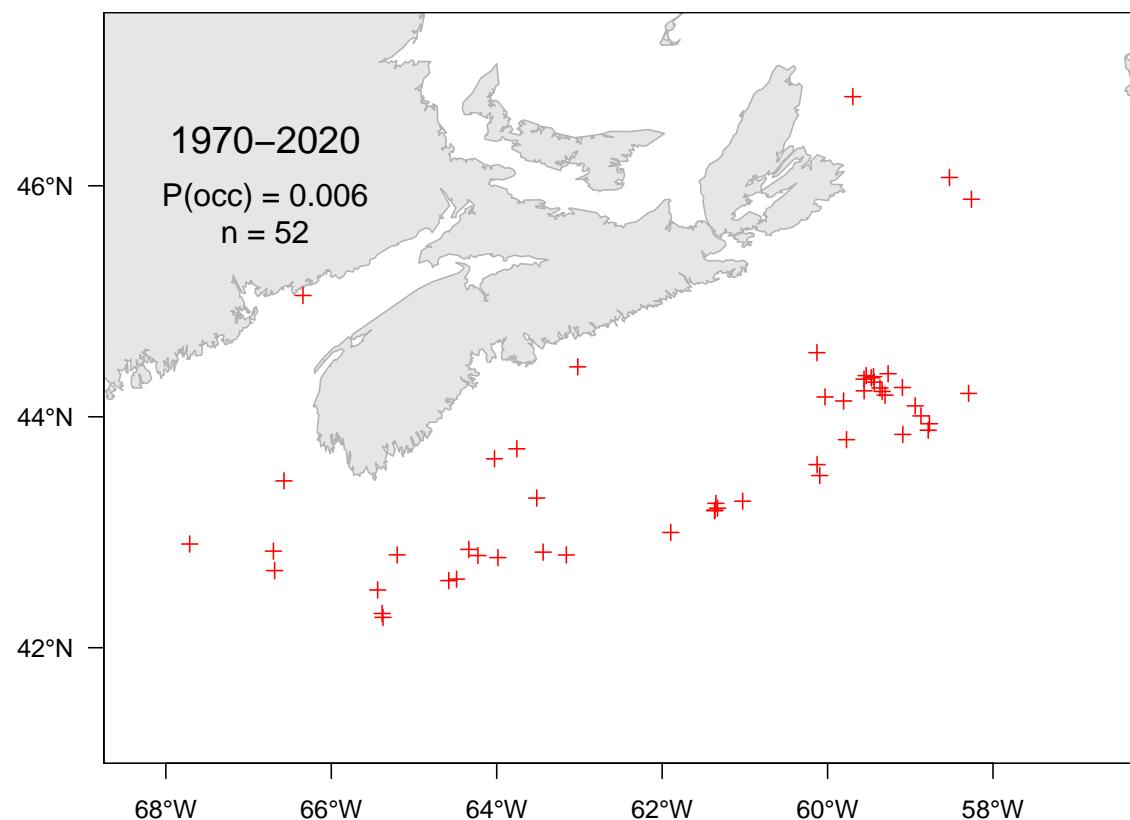


Figure 7.71A. Catch distribution for Silvery lightfish.

1102

## 7.72 Boa dragonfish (Dragon-boa) - species code 159 (category LR)

1103

Scientific name: [Stomias boa](#)

1104

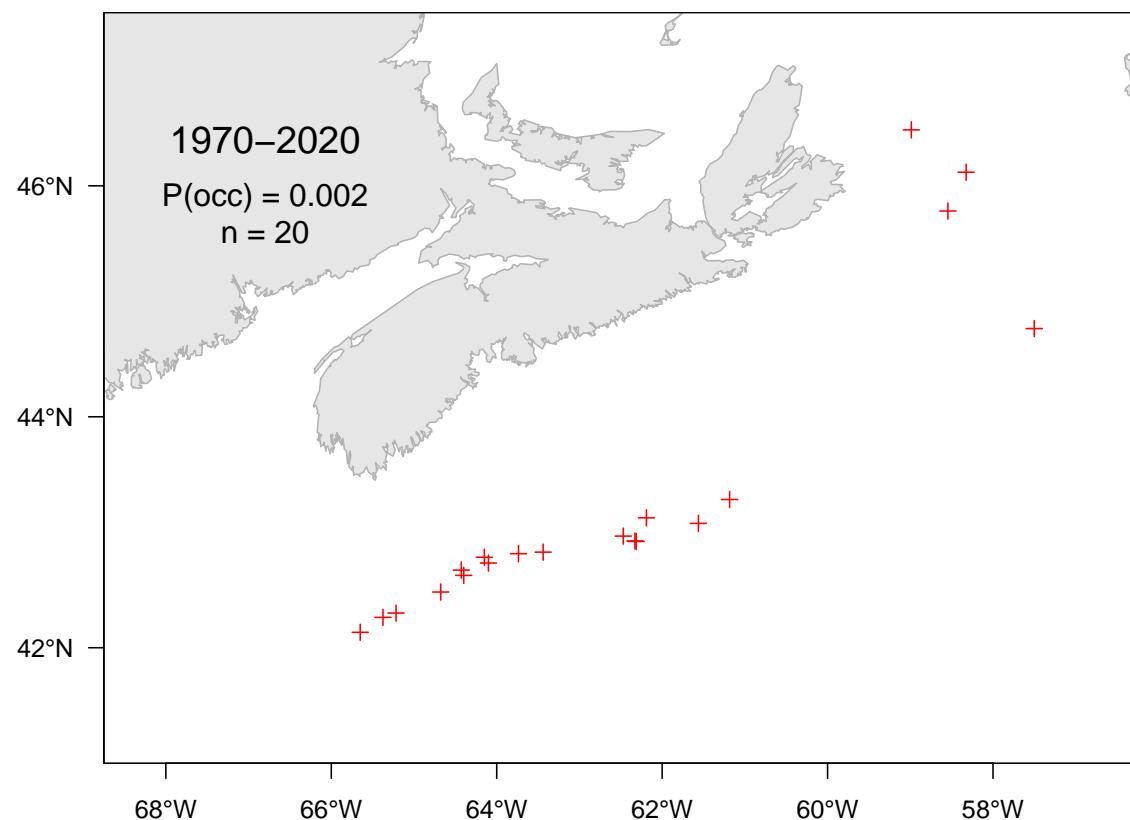


Figure 7.72A. Catch distribution for Boa dragonfish.

1105      **7.73 Shorthorn sculpin (Chabosseau à épines courtes) - species code 301 (category**  
1106      **LR)**

1107      Scientific name: [Myoxocephalus scorpius](#)

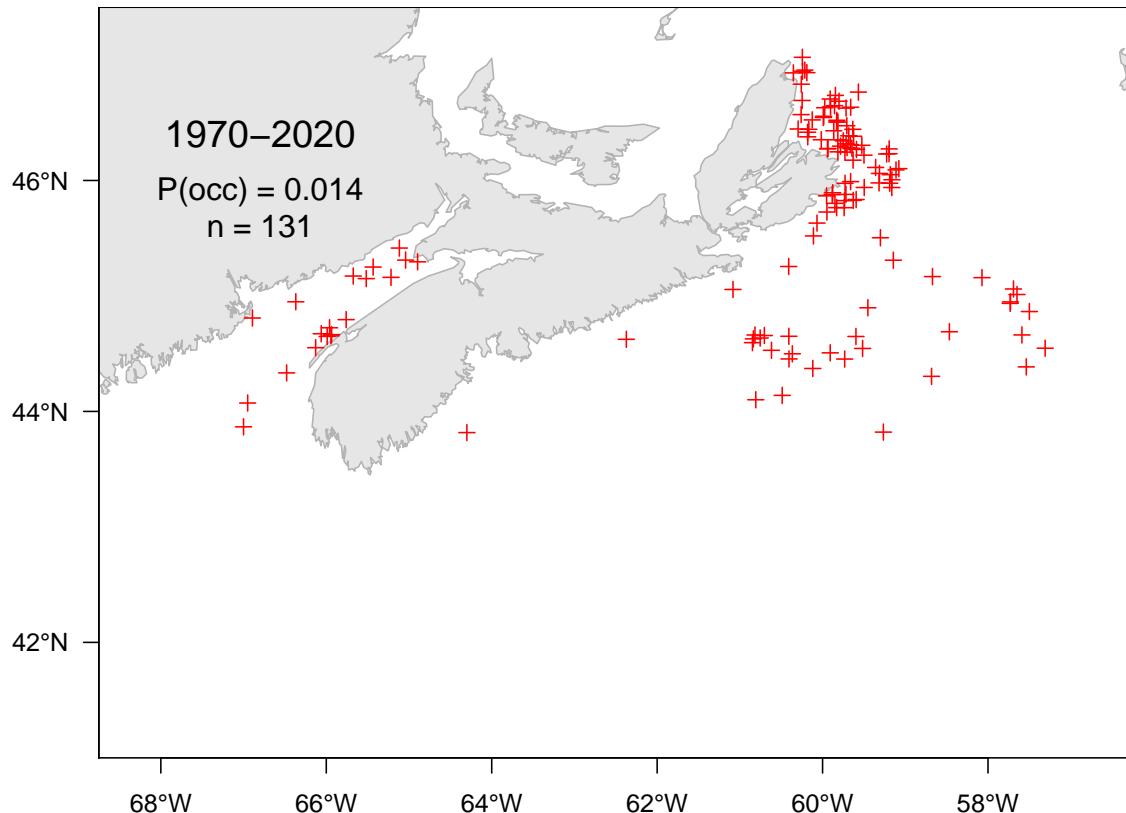


Figure 7.73A. Catch distribution for Shorthorn sculpin.

1109

## 7.74 Grubby (Chabosseau bronzé) - species code 303 (category LR)

1110

Scientific name: [Myoxocephalus aenaeus](#)

1111

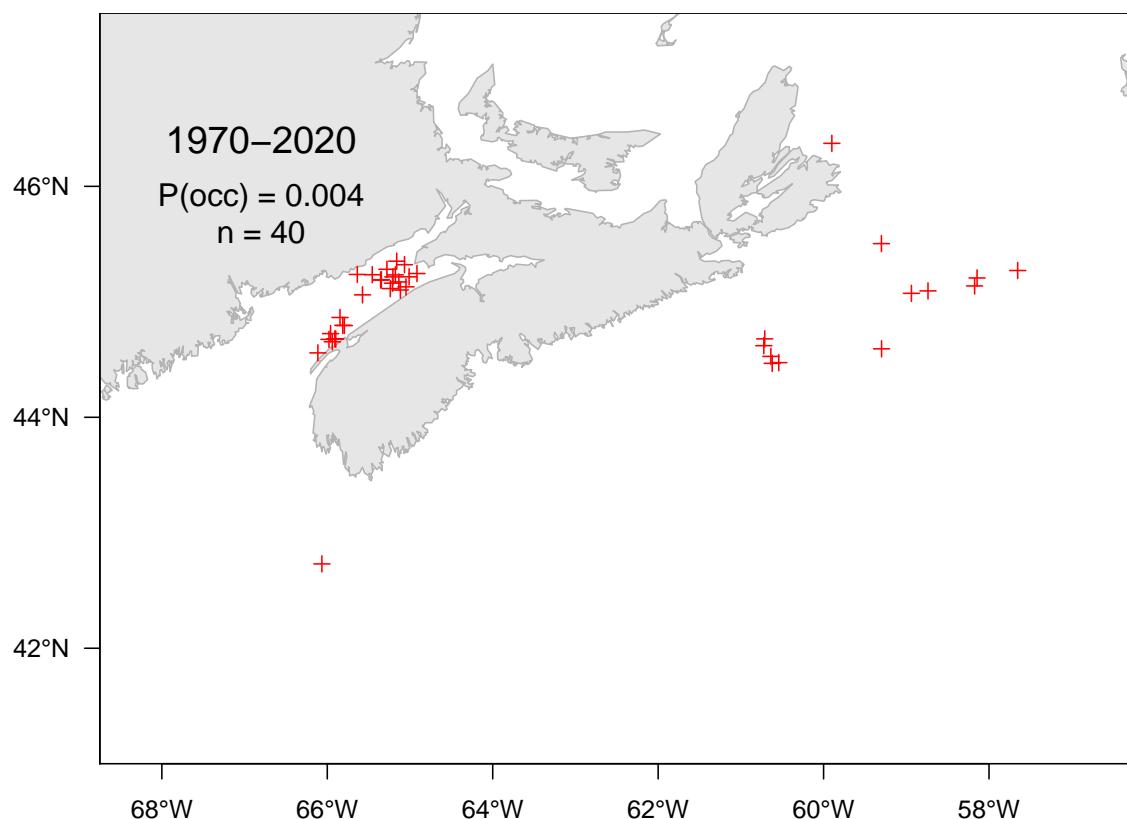


Figure 7.74A. Catch distribution for Grubby.

1112

## 7.75 Polar sculpin (Cotte polaire) - species code 307 (category LR)

1113

Scientific name: [Cottunculus microps](#)

1114

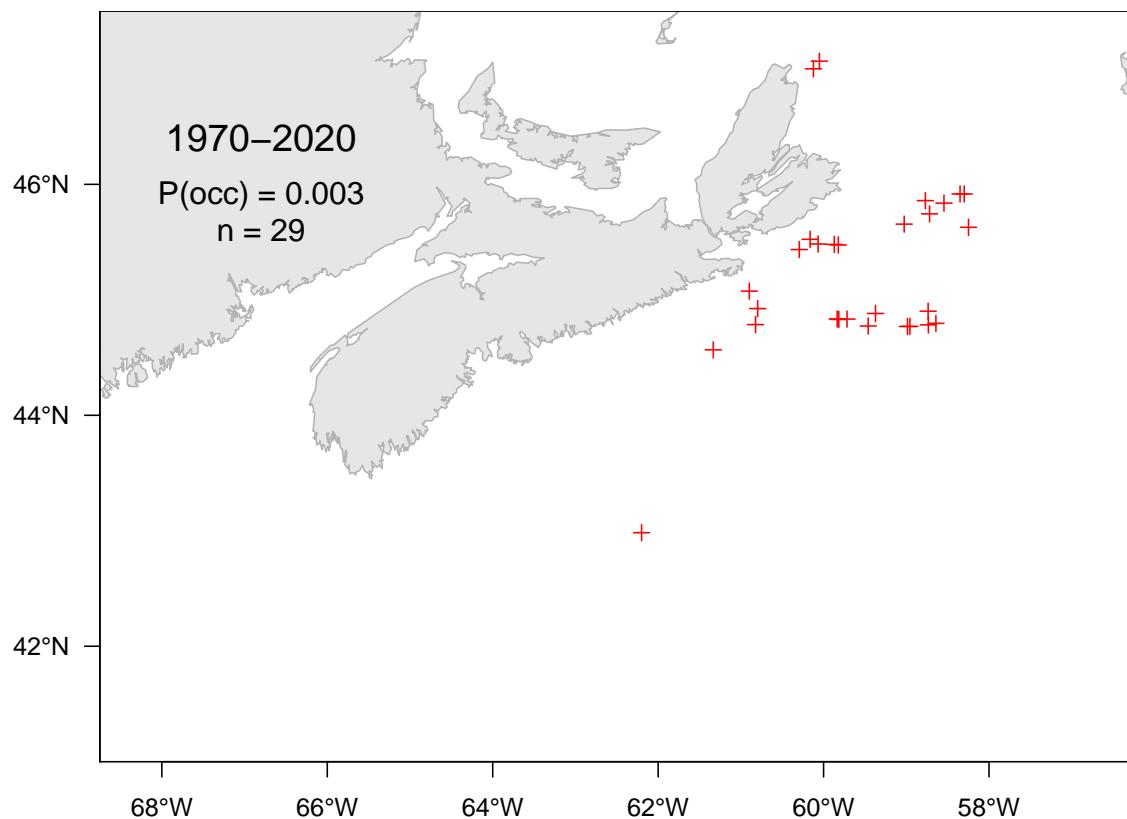
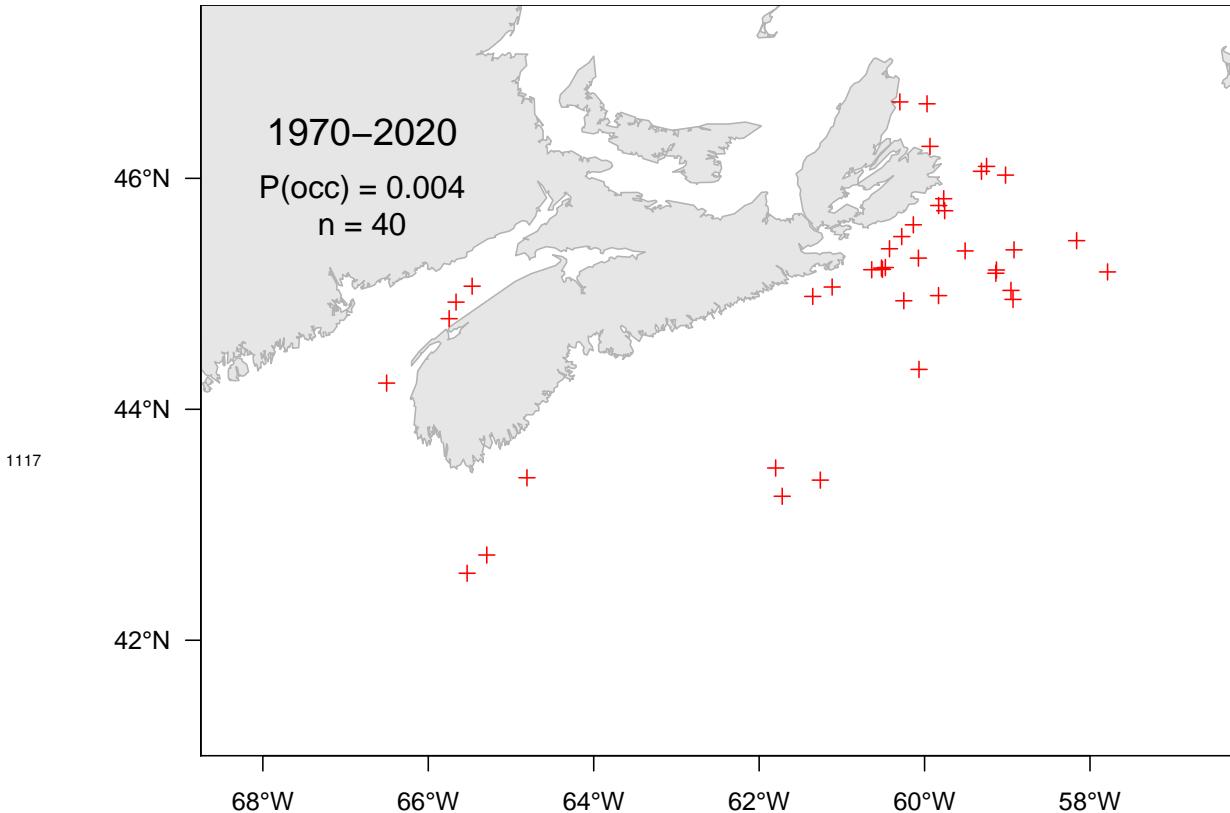


Figure 7.75A. Catch distribution for Polar sculpin.

1115      **7.76 Spatulate sculpin (Icèle spatulée) - species code 314 (category LR)**

1116      Scientific name: *Icelus spatula*



1118

## 7.77 Arctic alligatorfish (Poisson-alligator arctique) - species code 341 (category LR)

1119

Scientific name: [Ulcina olrikii](#)

1120

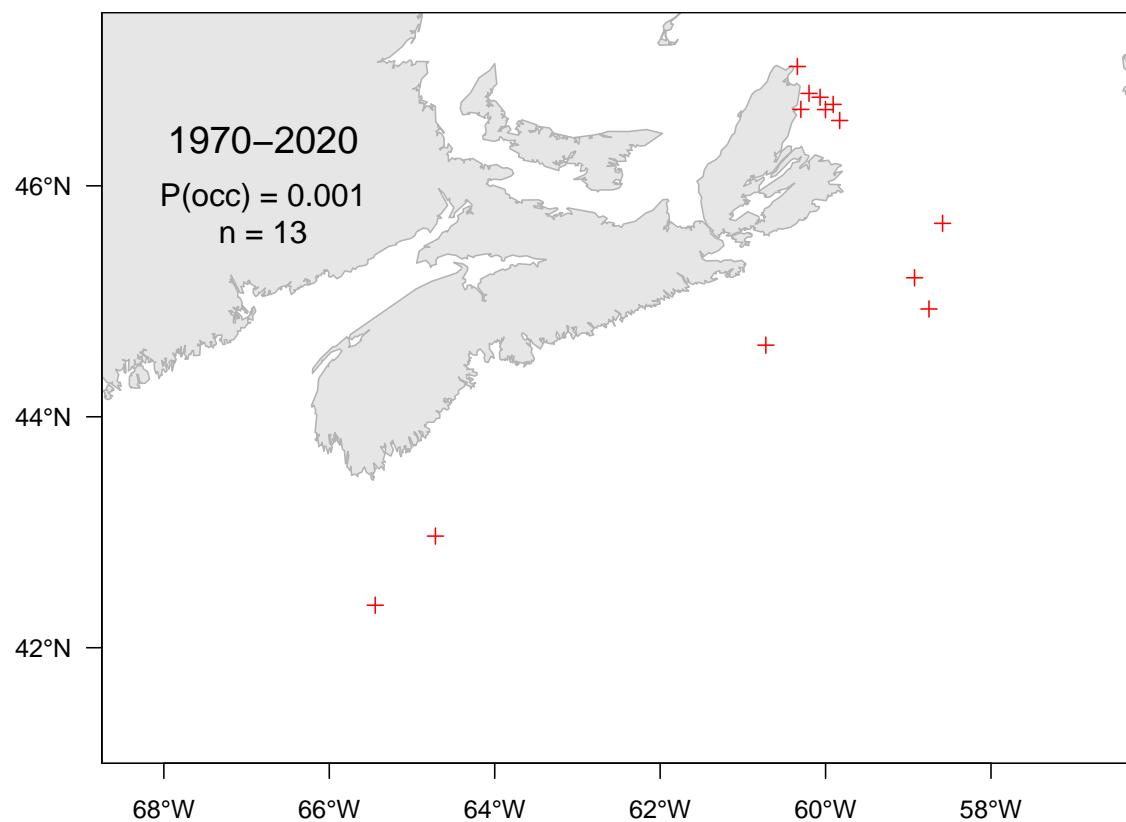


Figure 7.77A. Catch distribution for Arctic alligatorfish.

1121

## 7.78 Alligatorfishes (Poissons-alligator) - species code 351 (category LR)

1122

Scientific name: [Agonidae](#)

1123

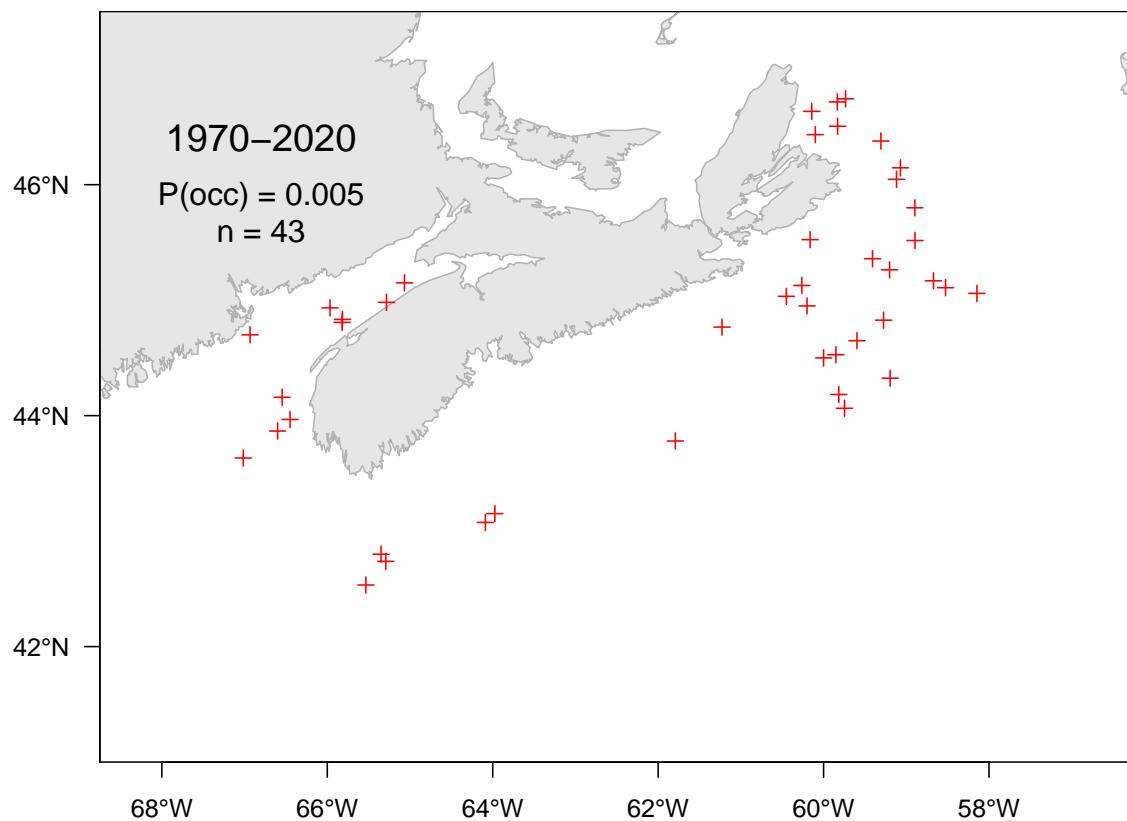


Figure 7.78A. Catch distribution for Alligatorfishes.

1124

## 7.79 Roughnose grenadier (Grenadier-scie) - species code 412 (category LR)

1125

Scientific name: [Trachyrincus murrayi](#)

1126

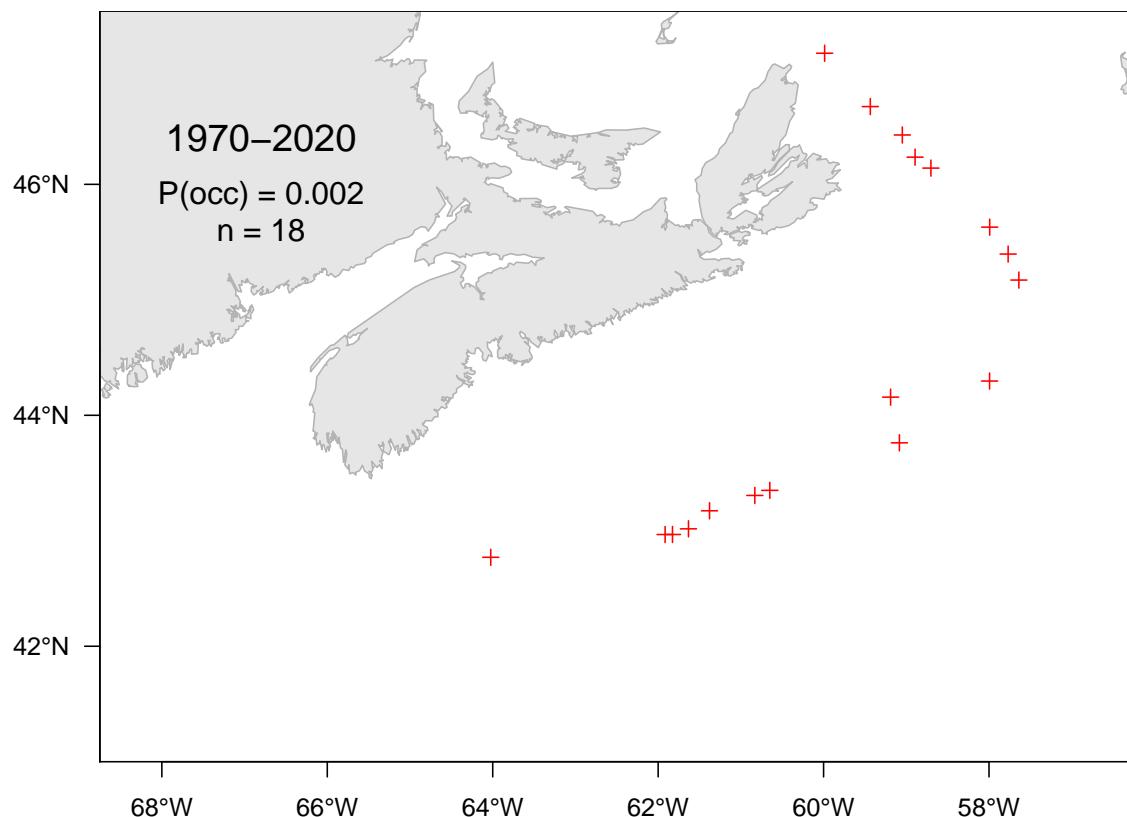


Figure 7.79A. Catch distribution for Roughnose grenadier.

1127      **7.80 Roundnose grenadier (Grenadier de roche) - species code 414 (category LR)**

1128      Scientific name: [Coryphaenoides rupestris](#)

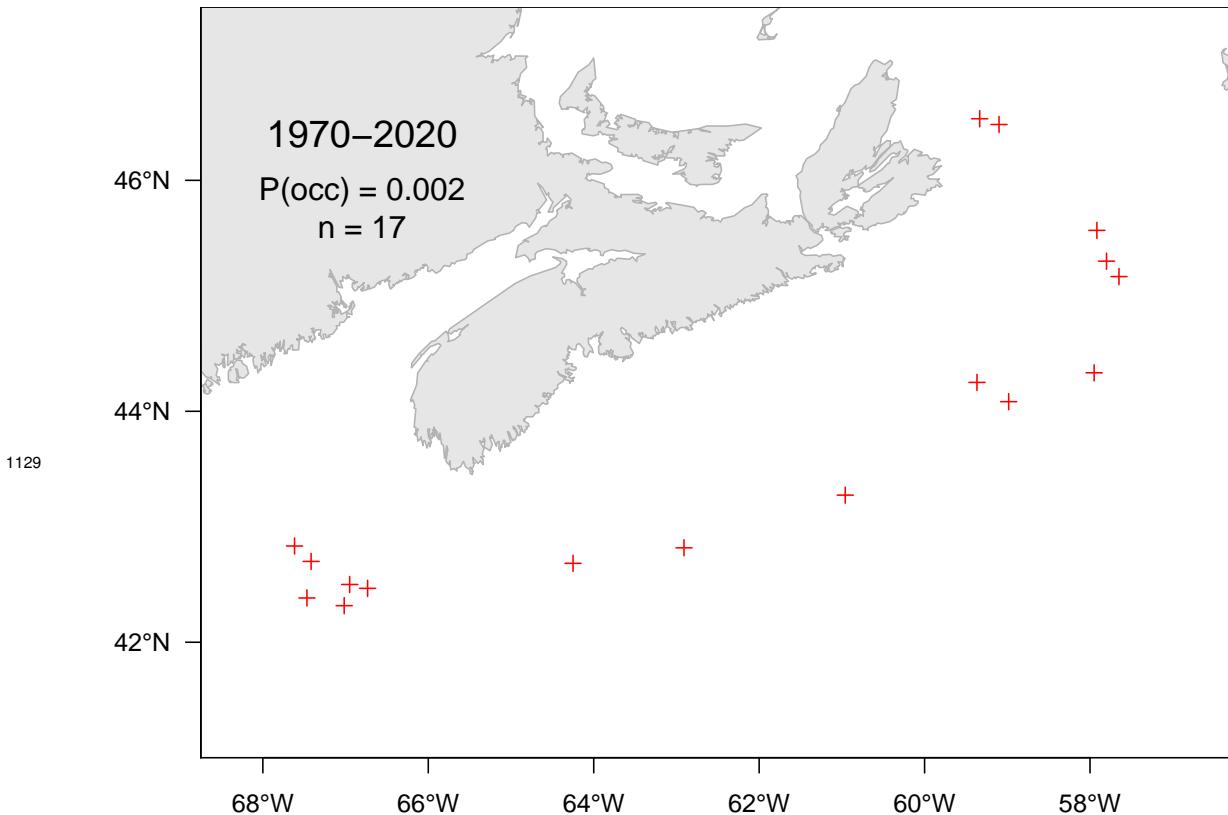


Figure 7.80A. Catch distribution for Roundnose grenadier.

1130

## 7.81 Atlantic seasnail (*Limace atlantique*) - species code 503 (category LR)

1131

Scientific name: [Liparis atlanticus](#)

1132

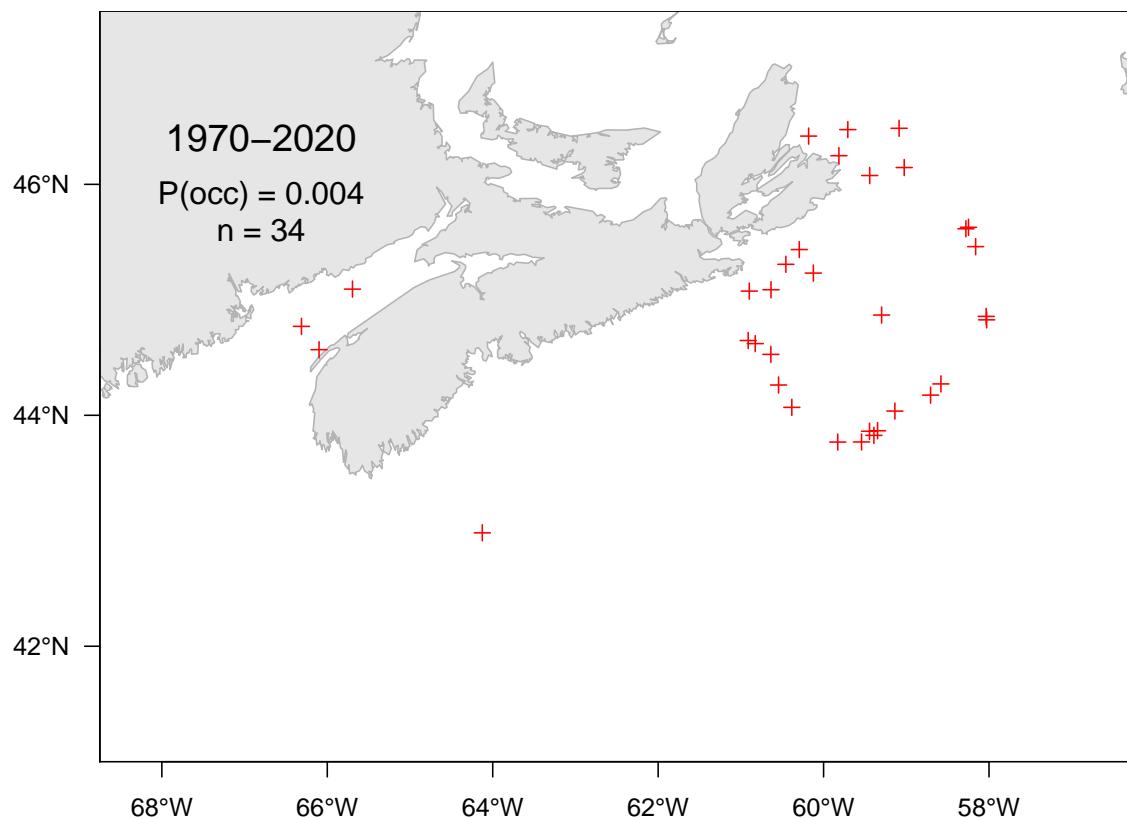


Figure 7.81A. Catch distribution for Atlantic seasnail.

1133

## 7.82 Gelatinous snailfish (*Limace gélatineuse*) - species code 505 (category LR)

1134

Scientific name: [Liparis fabricii](#)

1135

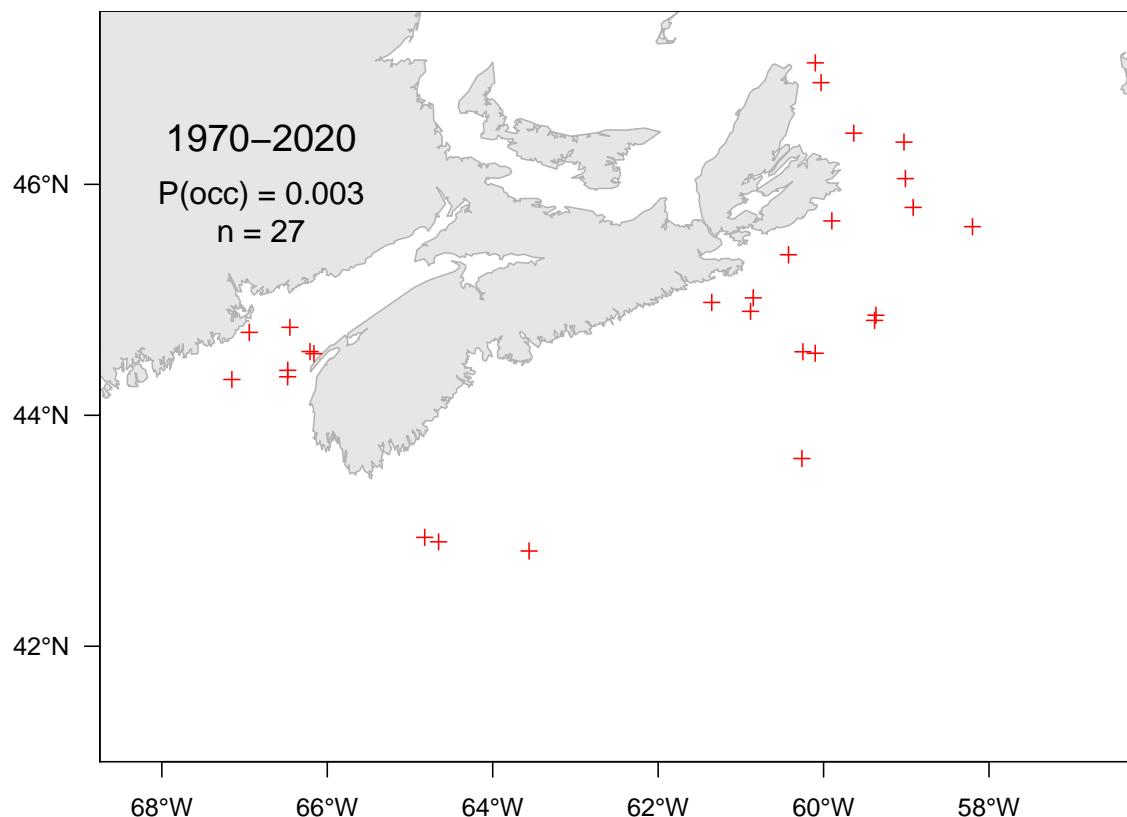


Figure 7.82A. Catch distribution for Gelatinous snailfish.

1136

### 7.83 Variegated snailfish (*Limace marbée*) - species code 512 (category LR)

1137

Scientific name: [Liparis gibbus](#)

1138

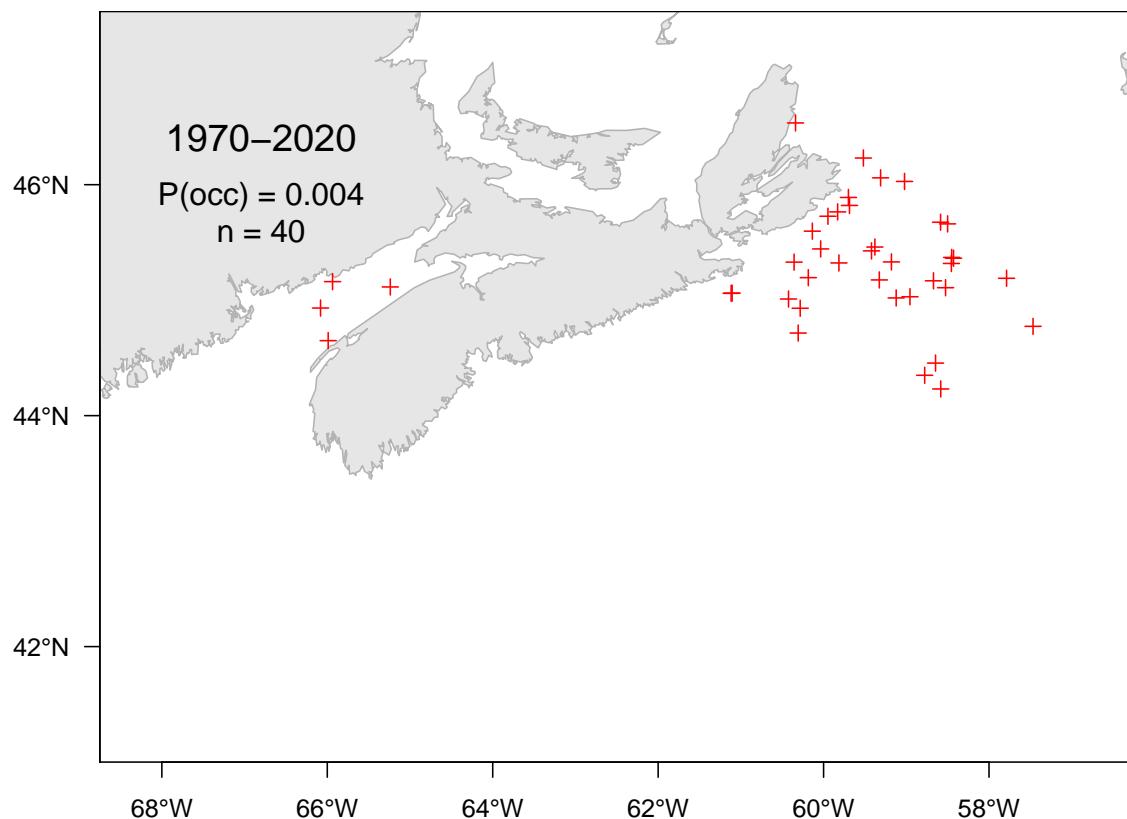


Figure 7.83A. Catch distribution for Variegated snailfish.

1139

## 7.84 Sea tadpole (Petite limace de mer) - species code 520 (category LR)

1140

Scientific name: [Careproctus reinhardtii](#)

1141

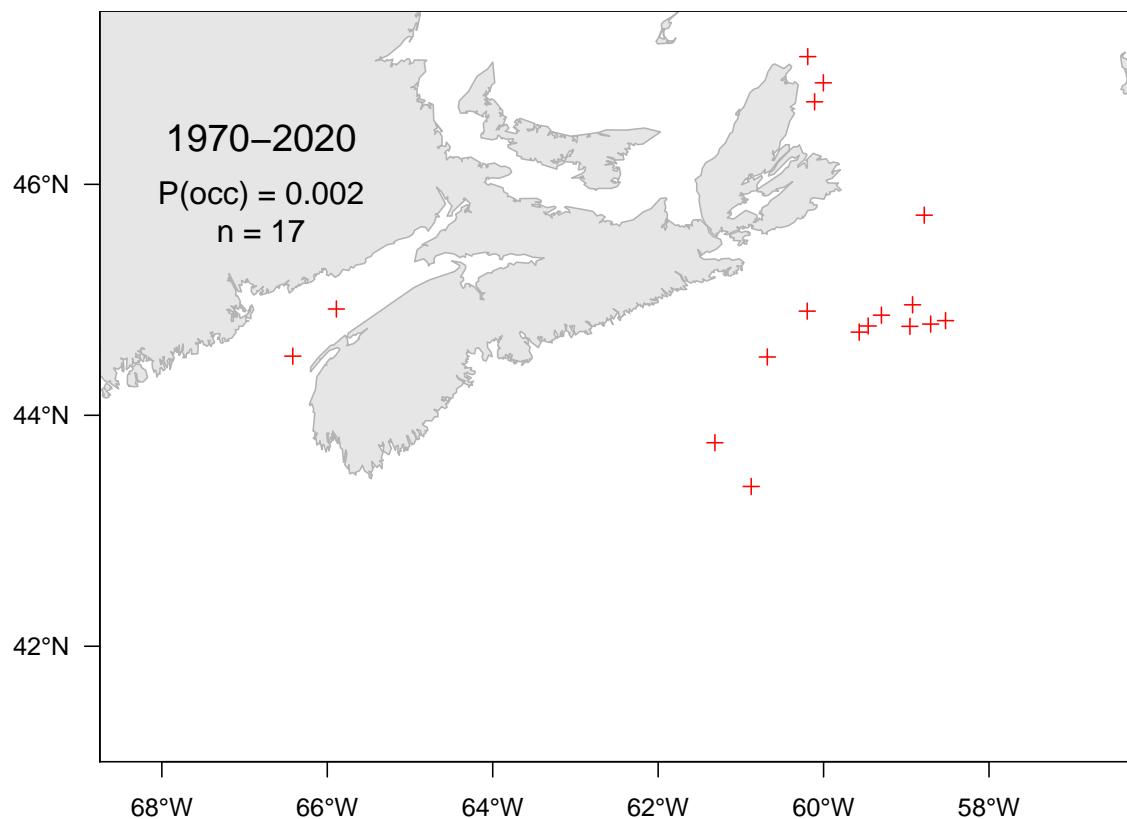


Figure 7.84A. Catch distribution for Sea tadpole.

1142

## 7.85 Wolf eelpout (*Lycodes à tête longue*) - species code 603 (category LR)

1143

Scientific name: [Lycenchelys verrillii](#)

1144

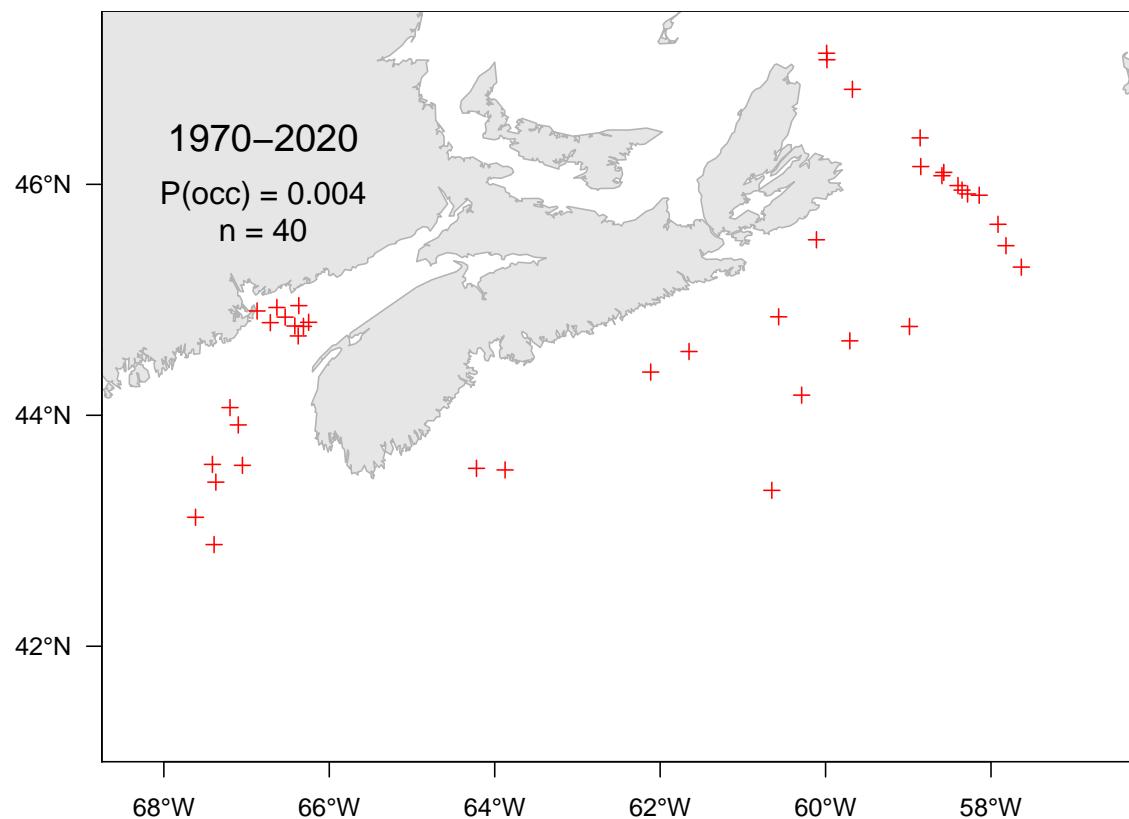


Figure 7.85A. Catch distribution for Wolf eelpout.

1145

## 7.86 Slender snipe eel (*Avocette ruban*) - species code 604 (category LR)

1146

Scientific name: [Nemichthys scolopaceus](#)

1147

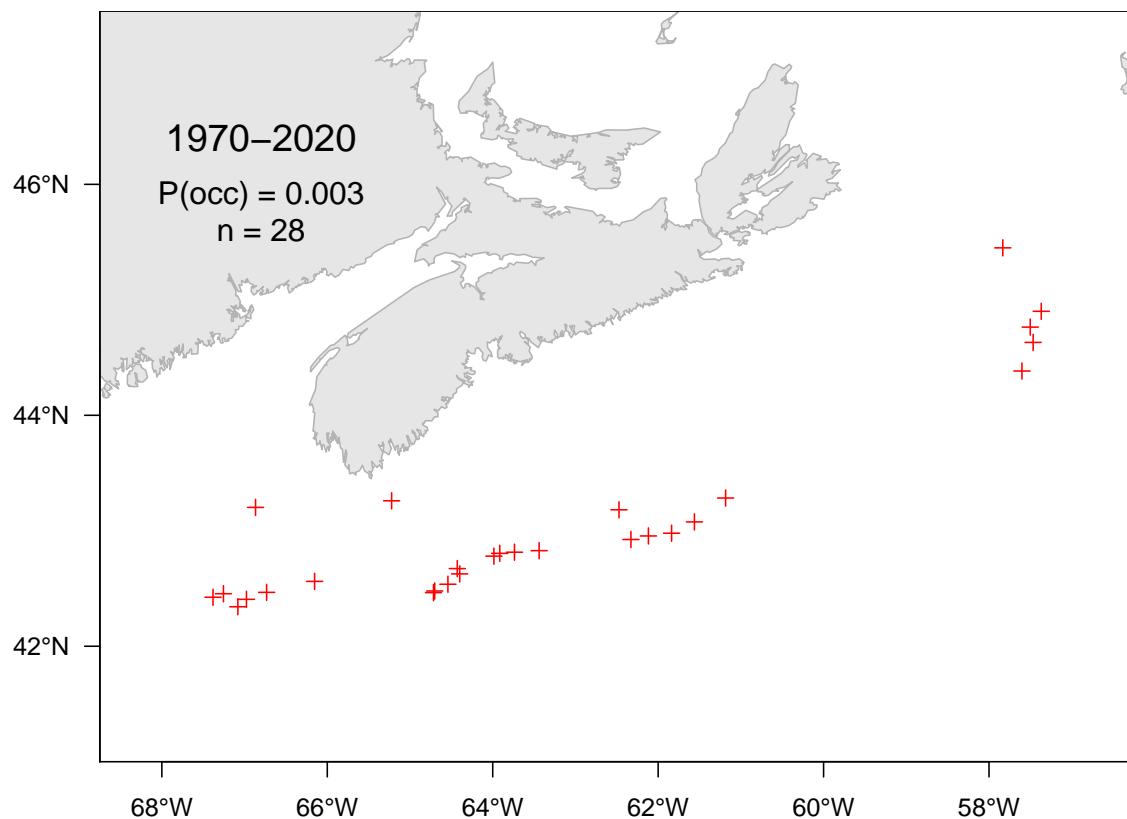


Figure 7.86A. Catch distribution for Slender snipe eel.

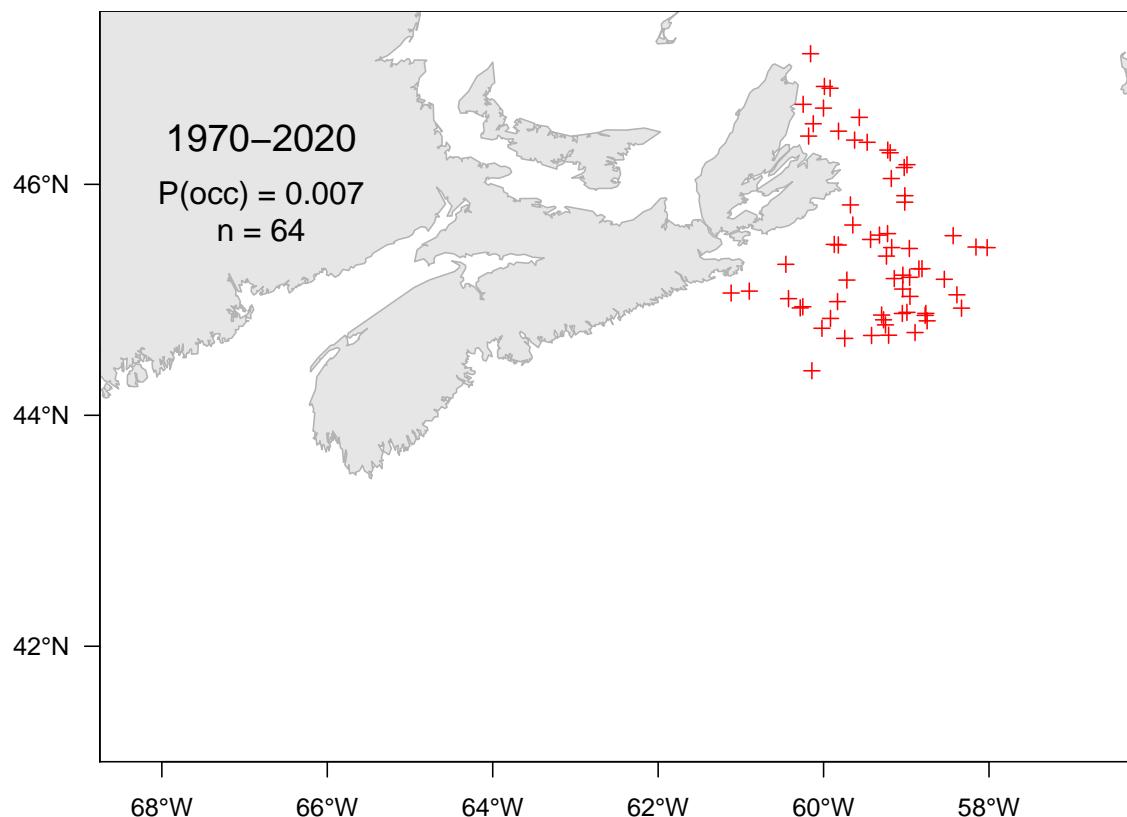
1148

## 7.87 Newfoundland eelpout (*Lycodes* du Labrador) - species code 619 (category LR)

1149

Scientific name: [Lycodes terraenovae](#)

1150



1151

## 7.88 Newfoundland eelpout (*Lycodes lavalaei*) - species code 620 (category LR)

1152

Scientific name: [Lycodes lavalaei](#)

1153

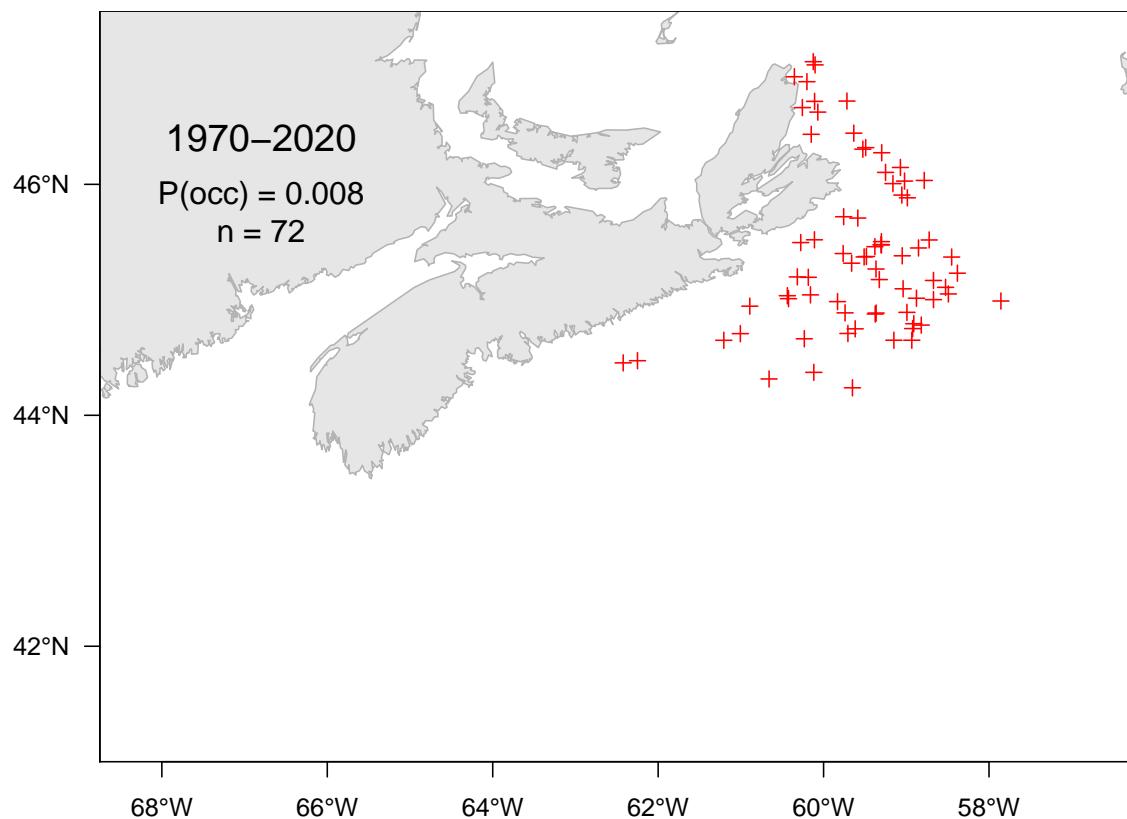


Figure 7.88A. Catch distribution for Newfoundland eelpout.

1154

### 7.89 Rock gunnel (Sigouine de roche) - species code 621 (category LR)

1155

Scientific name: [Pholis gunnellus](#)

1156

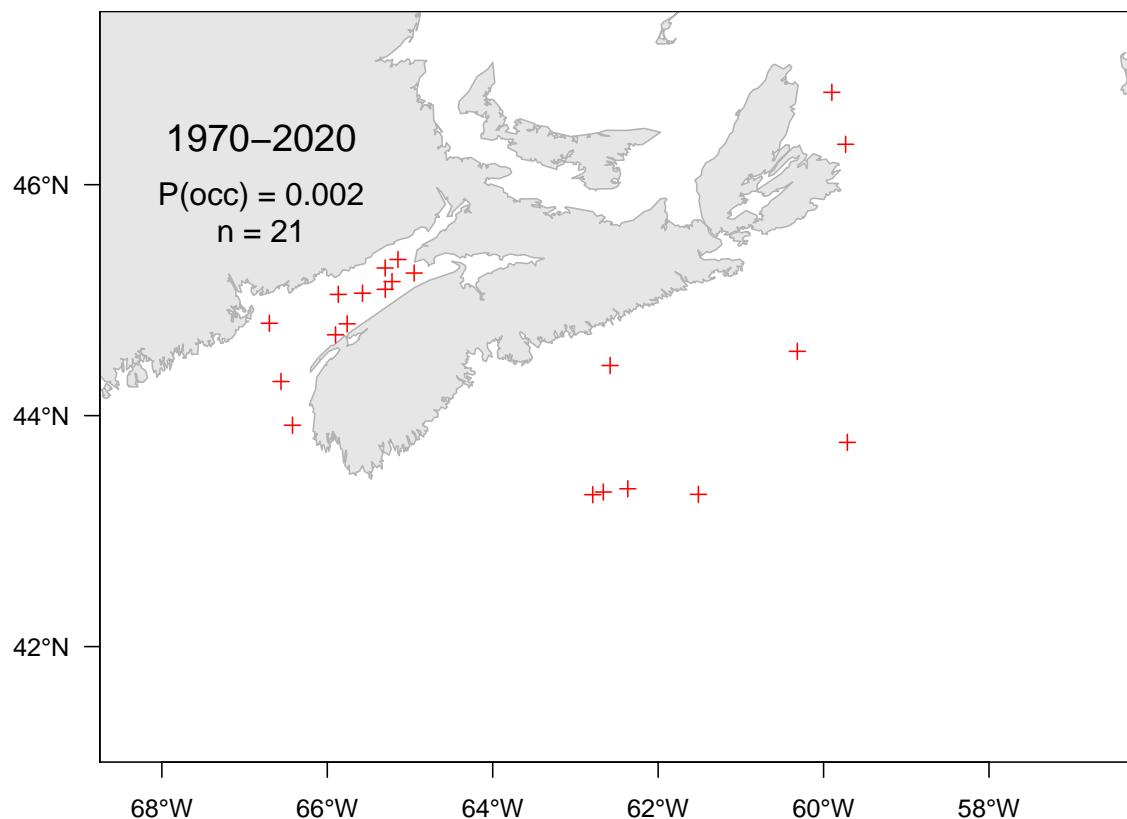


Figure 7.89A. Catch distribution for Rock gunnel.

1157

## 7.90 Radiated shanny (*Ulvaria deux-lignes*) - species code 625 (category LR)

1158

Scientific name: [Ulvaria subbifurcata](#)

1159

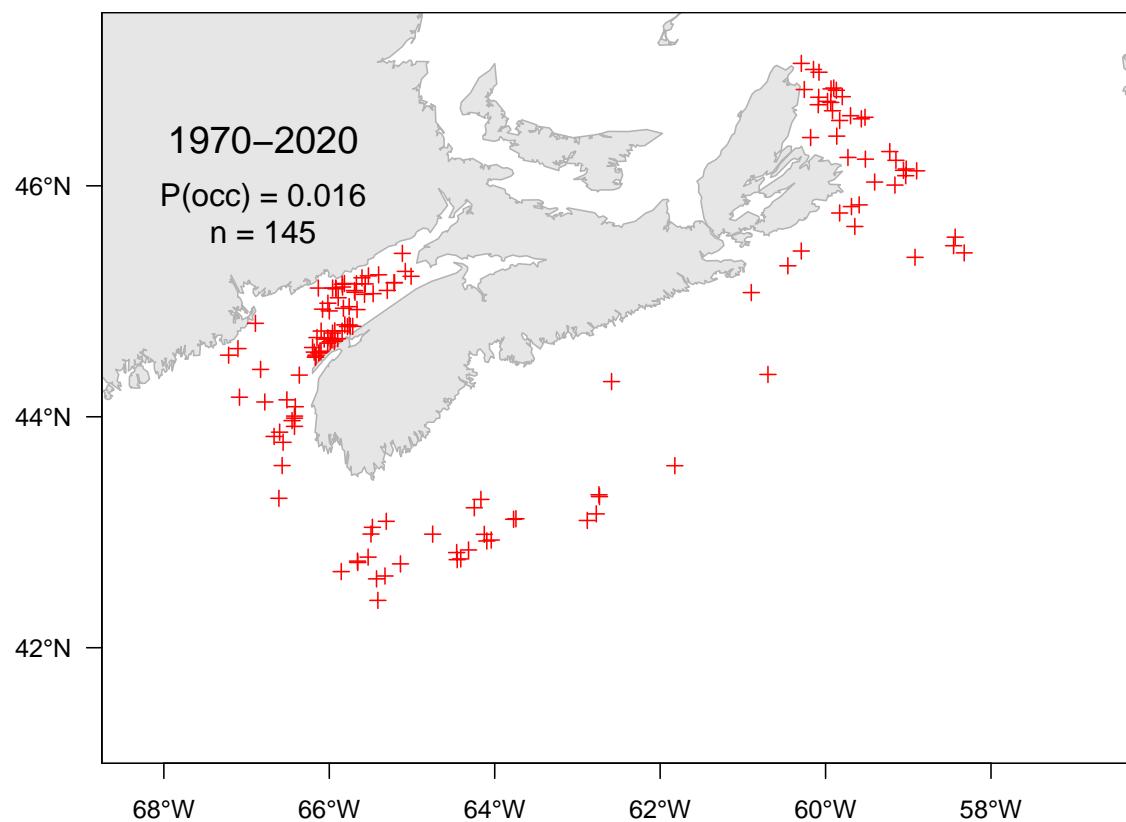


Figure 7.90A. Catch distribution for Radiated shanny.

1160

## 7.91 Fourline snakeblenny (Quatre-lignes atlantique) - species code 626 (category LR)

1161

Scientific name: [Eumesogrammus praecisus](#)

1162

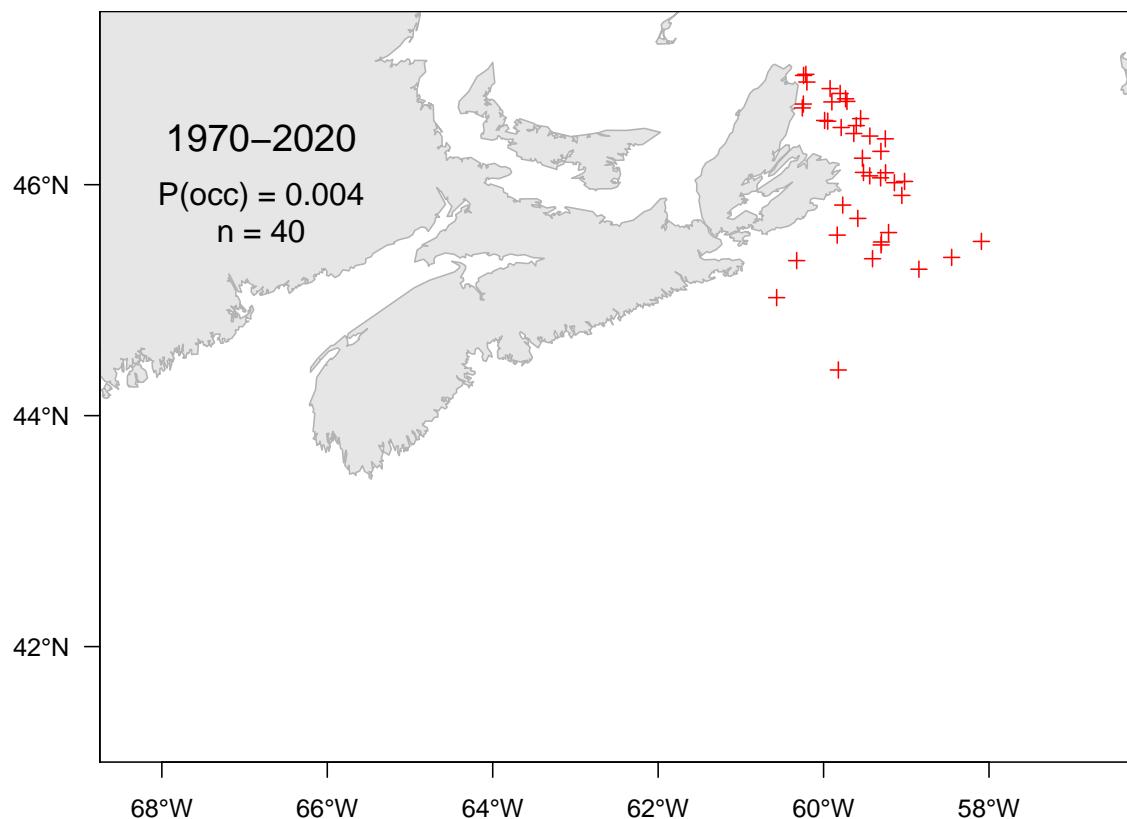


Figure 7.91A. Catch distribution for Fourline snakeblenny.

1163

## 7.92 Wrymouth (Terrassier tacheté) - species code 630 (category LR)

1164

Scientific name: [Cryptacanthodes maculatus](#)

1165

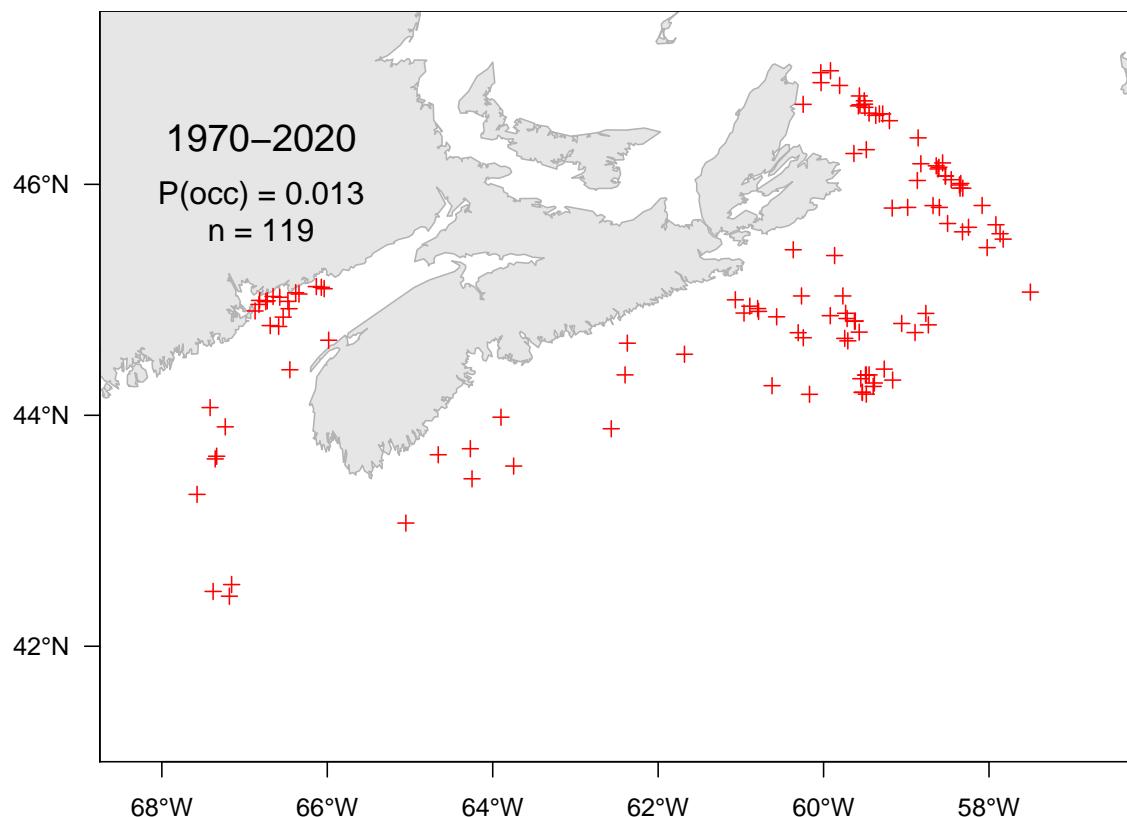


Figure 7.92A. Catch distribution for Wrymouth.

1166

### 7.93 Spotfin dragonet (Dragonnet tacheté) - species code 637 (category LR)

1167

Scientific name: [Foetorepus agassizii](#)

1168

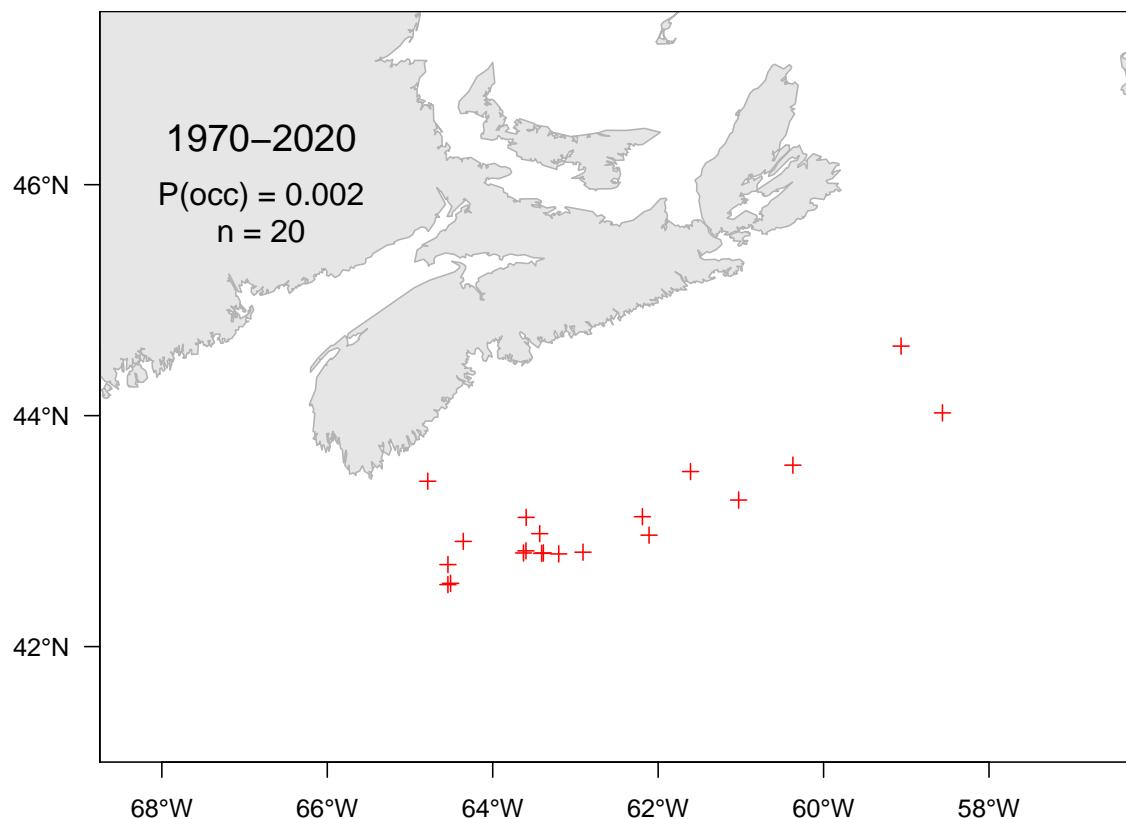


Figure 7.93A. Catch distribution for Spotfin dragonet.

1169

## 7.94 Arctic eelpout (*Lycodes arctique*) - species code 641 (category LR)

1170

Scientific name: [Lycodes reticulatus](#)

1171

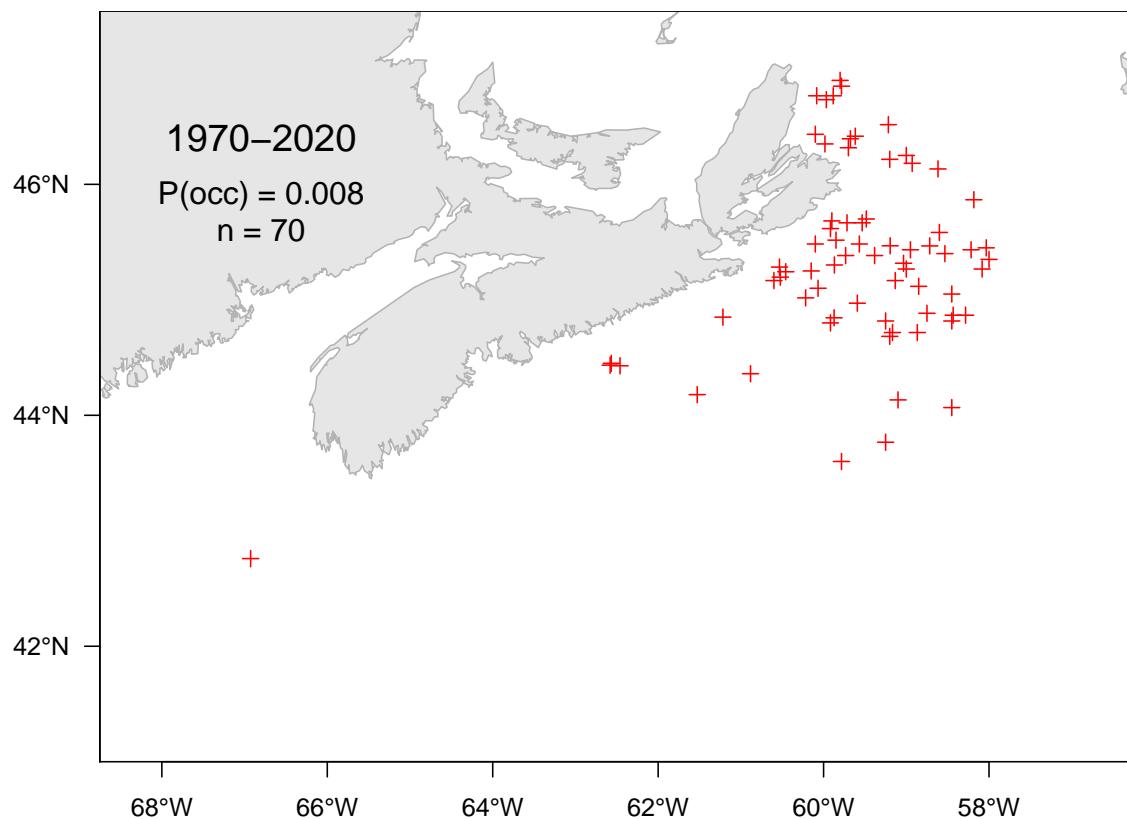


Figure 7.94A. Catch distribution for Arctic eelpout.

1172

## 7.95 Atlantic soft pout (*Molasse atlantique*) - species code 646 (category LR)

1173

Scientific name: [Melanostigma atlanticum](#)

1174

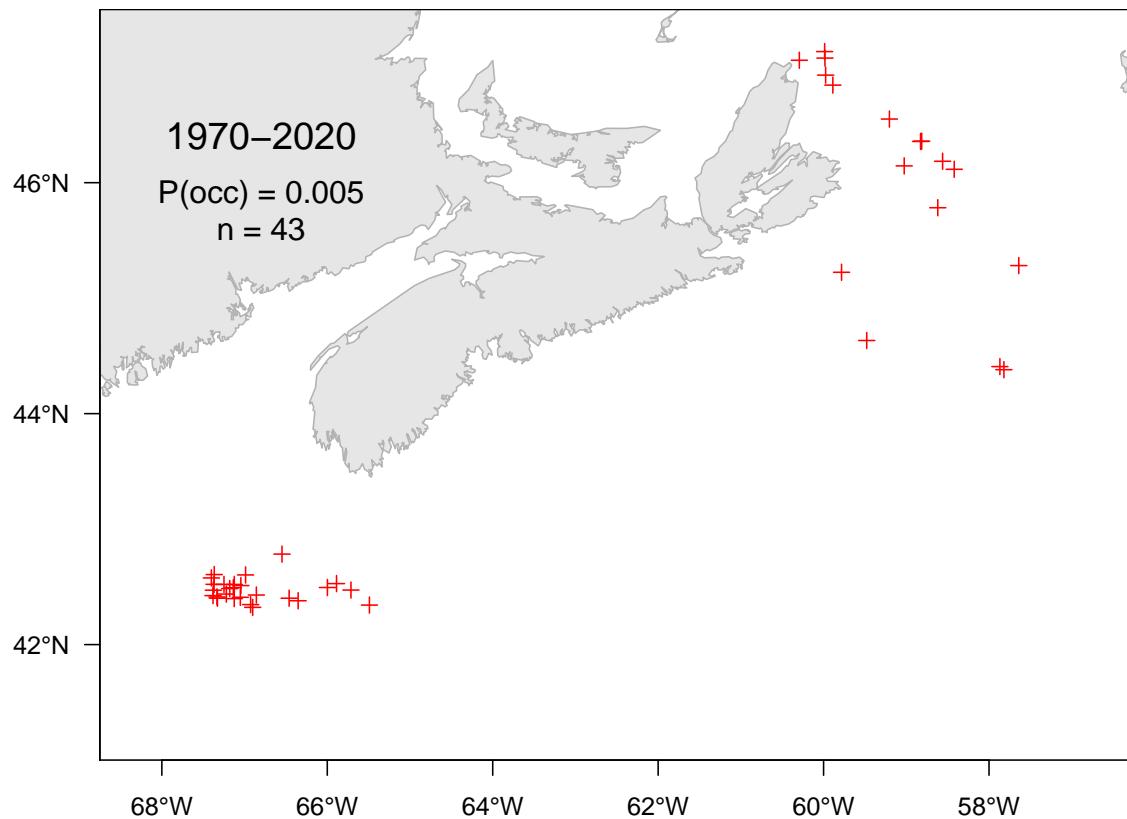


Figure 7.95A. Catch distribution for Atlantic soft pout.

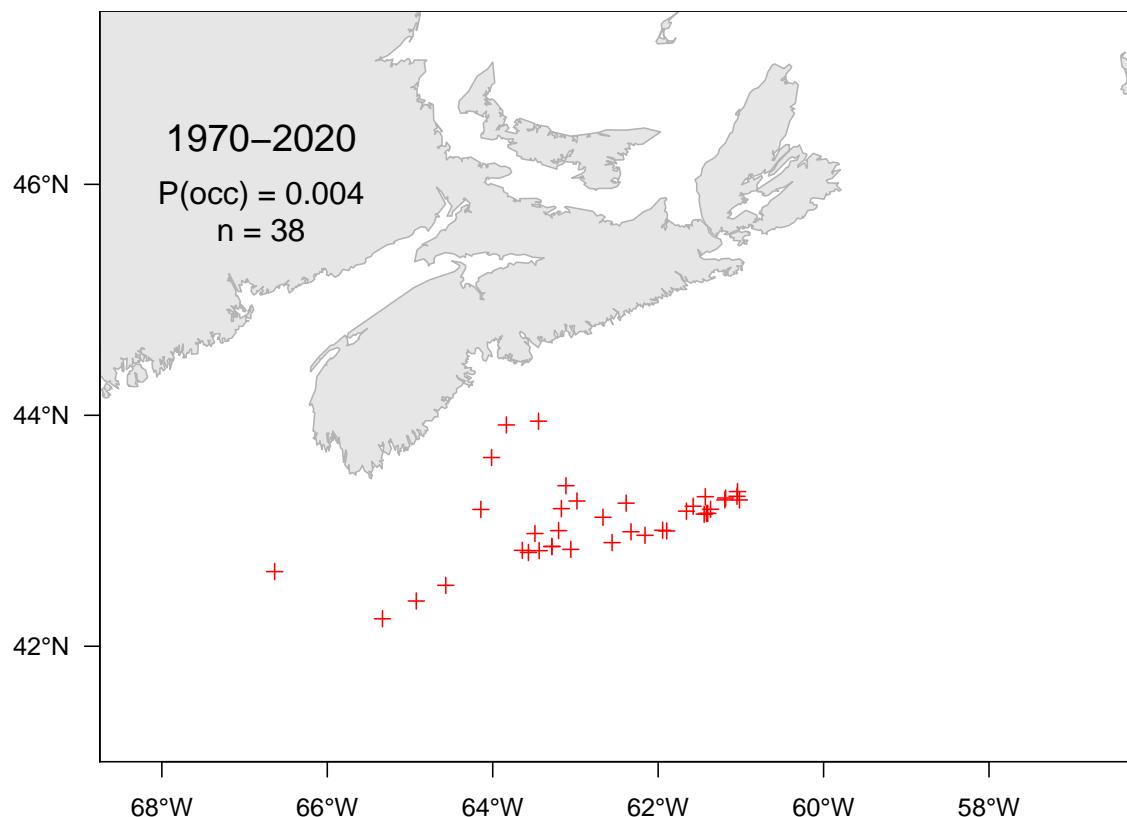
1175

## 7.96 Silvery John dory (Saint Pierre argenté) - species code 704 (category LR)

1176

Scientific name: [Zenopsis conchifer](#)

1177



1178

## 7.97 White barracudina (*Lussion blanc*) - species code 712 (category LR)

1179

Scientific name: [Arctozenus risso](#)

1180

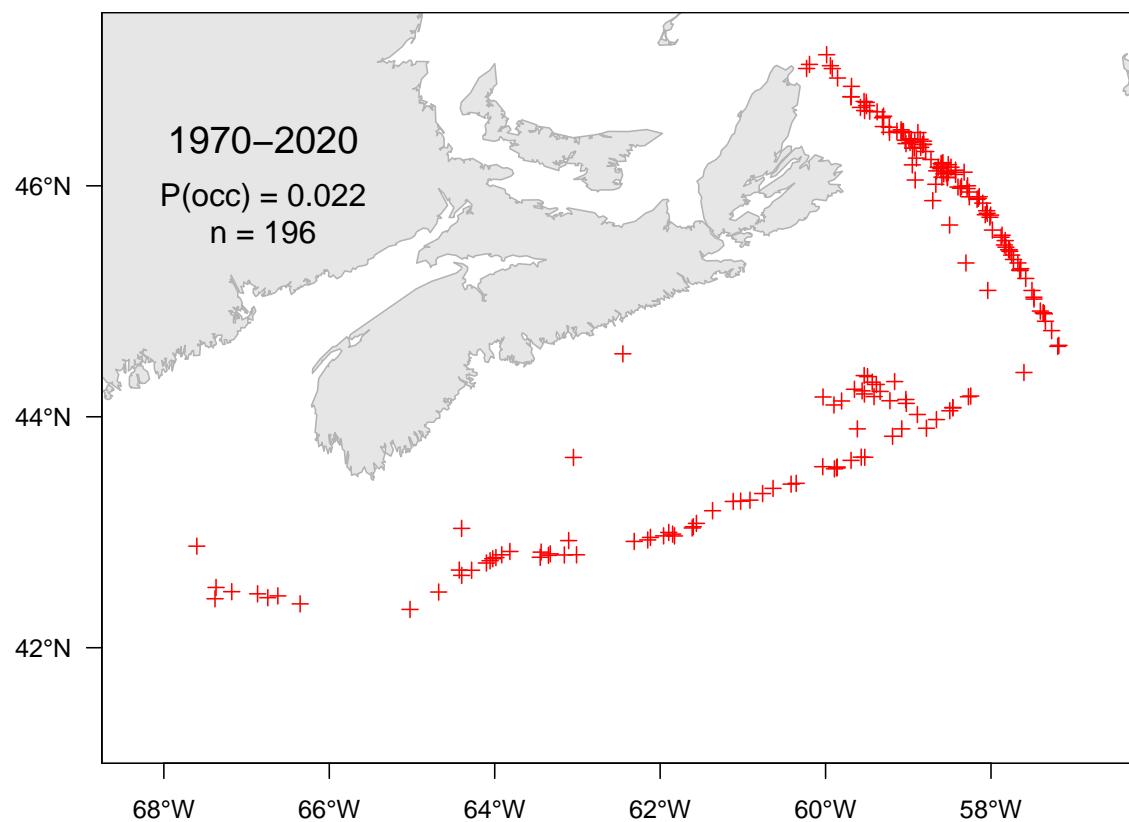


Figure 7.97A. Catch distribution for White barracudina.

1181

## 7.98 Atlantic saury (*Balaou atlantique*) - species code 720 (category LR)

1182

Scientific name: [Scomberesox saurus](#)

1183

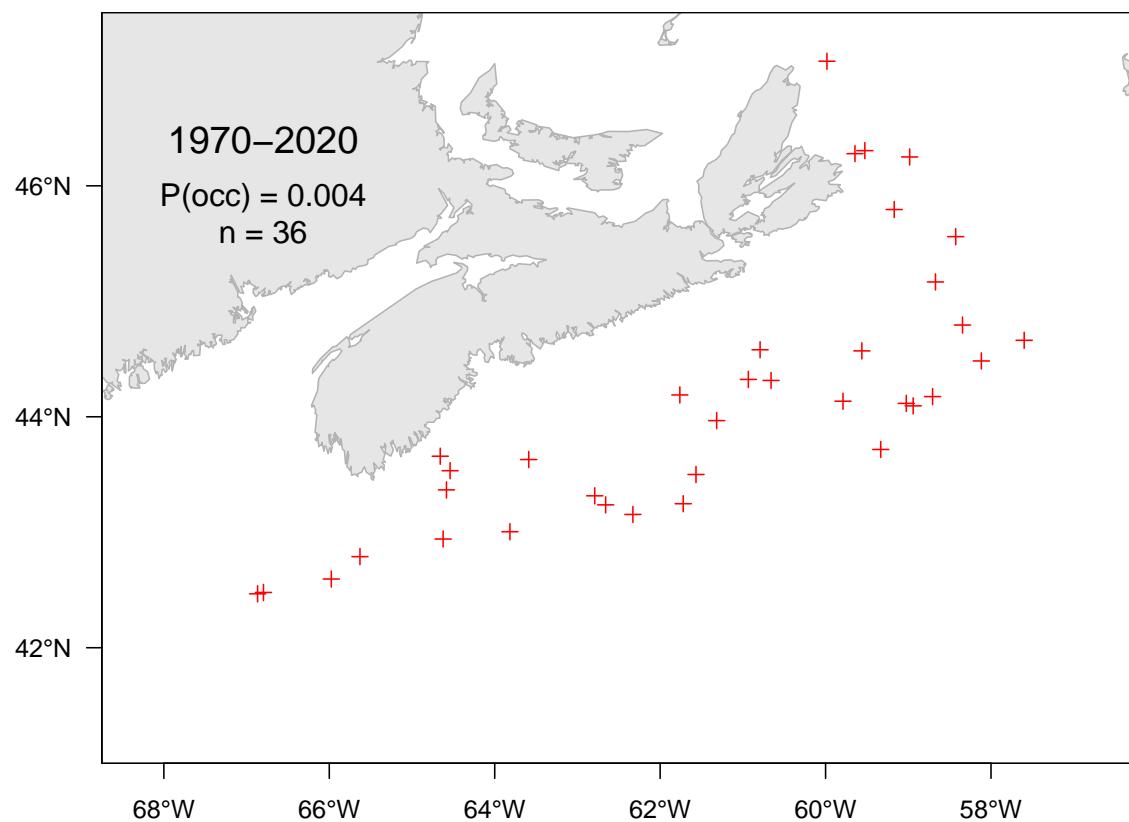


Figure 7.98A. Catch distribution for Atlantic saury.

1184

### 7.99 Hatchetfishes (Haches d'argent) - species code 741 (category LR)

1185

Scientific name: [Sternopychidae](#)

1186

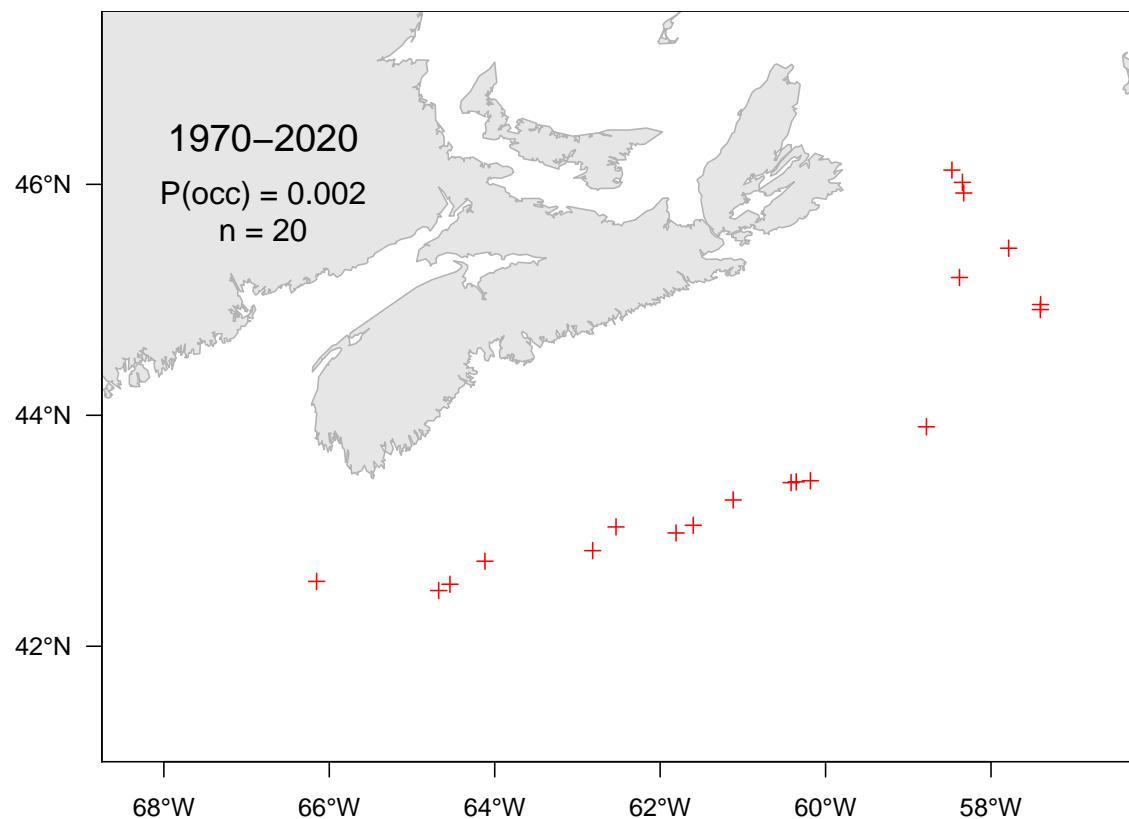


Figure 7.99A. Catch distribution for Hatchetfishes.

1187

## 7.100 Atlantic batfish (*Malthe atlantique*) - species code 742 (category LR)

1188

Scientific name: [Dibranchus atlanticus](#)

1189

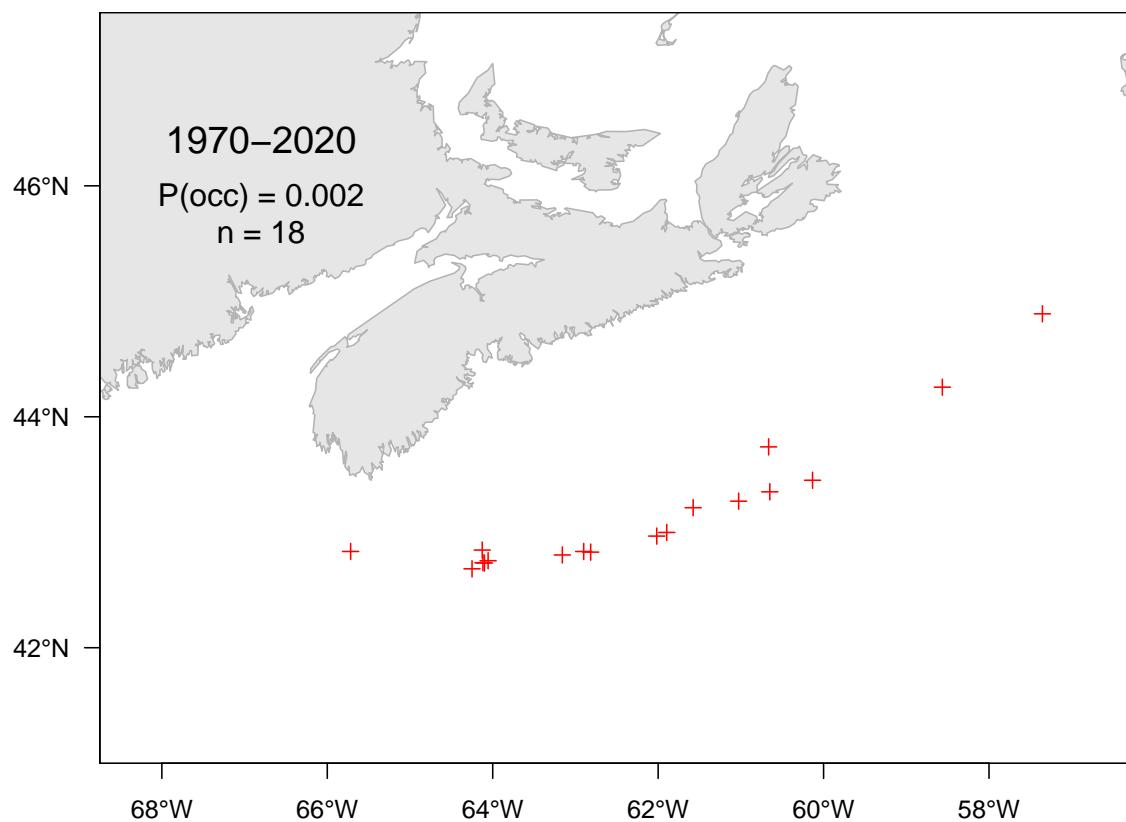


Figure 7.100A. Catch distribution for Atlantic batfish.

1190

### 7.101 Spottedfin tonguefish (*Langue fil noir*) - species code 816 (category LR)

1191

Scientific name: *Syphurus diomedeanus*

1192

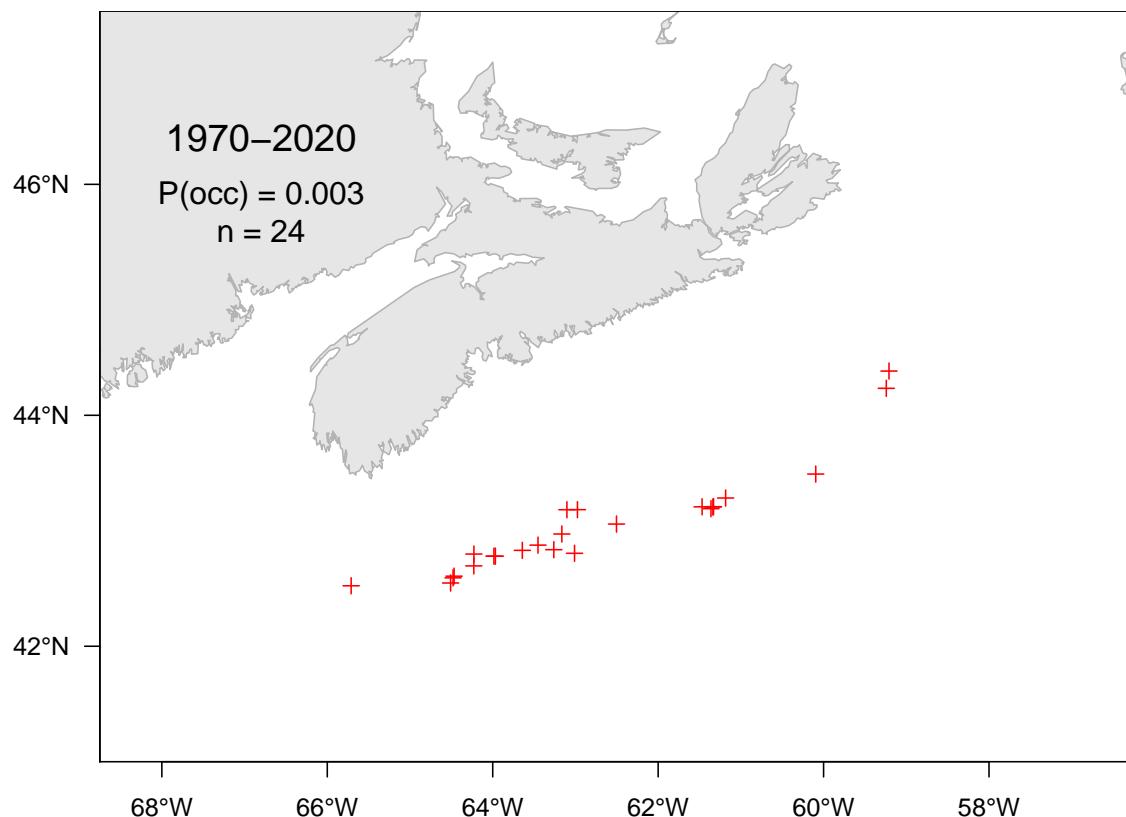


Figure 7.101A. Catch distribution for Spottedfin tonguefish.

1193

### 7.102 Black dogfish (Aiguillat noir) - species code 221 (category LR)

1194

Scientific name: [Centroscyllium fabricii](#)

1195

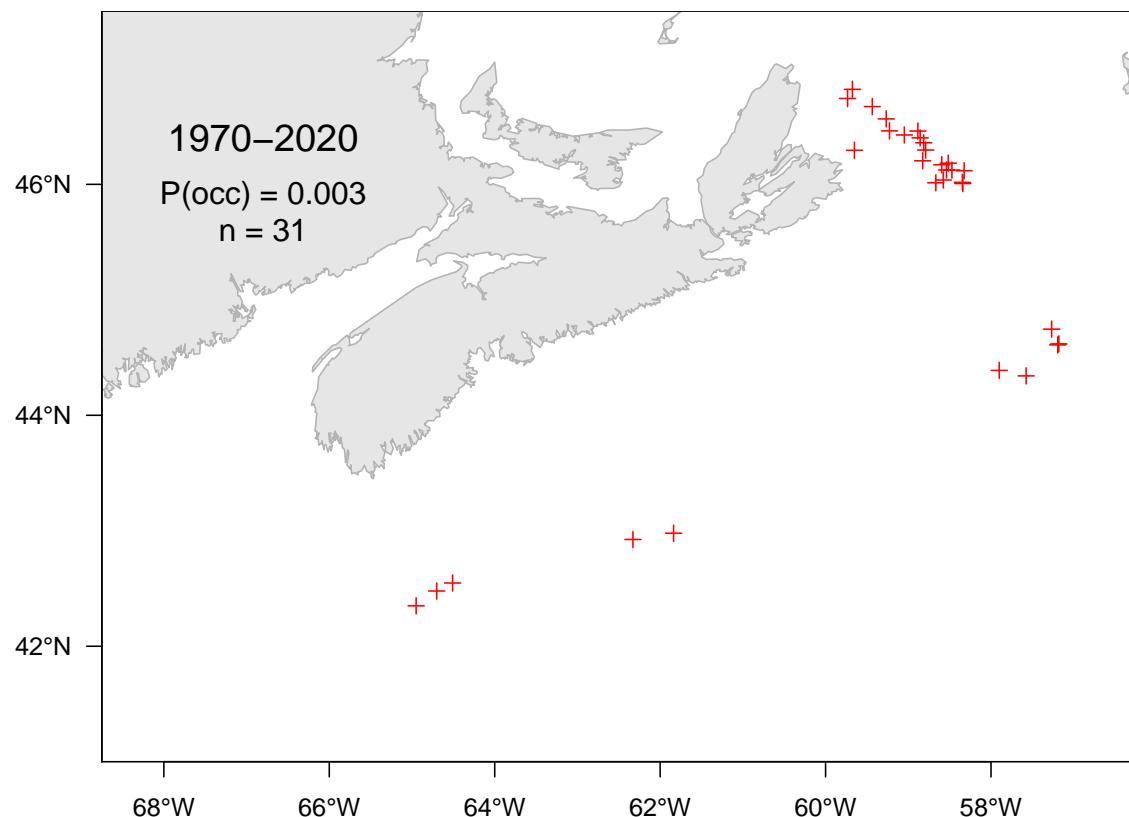


Figure 7.102A. Catch distribution for Black dogfish.

1196

### 7.103 Longfin inshore squid (*Calmar totam*) - species code 4512 (category LR)

1197

Scientific name: [Doryteuthis pealeii](#)

1198

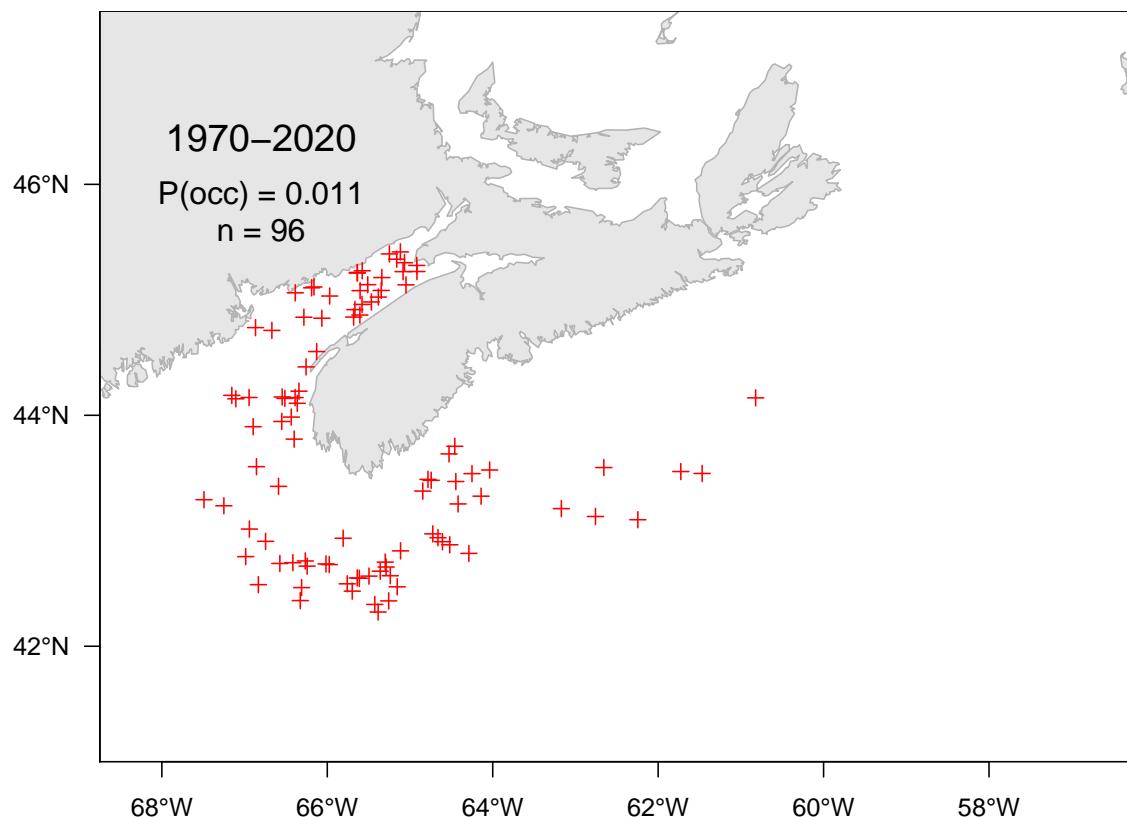


Figure 7.103A. Catch distribution for Longfin inshore squid.

1199

#### 7.104 Red deepsea crab (Crabe rouge) - species code 2532 (category SR)

1200

Scientific name: [Chaceon quinquedens](#)

1201

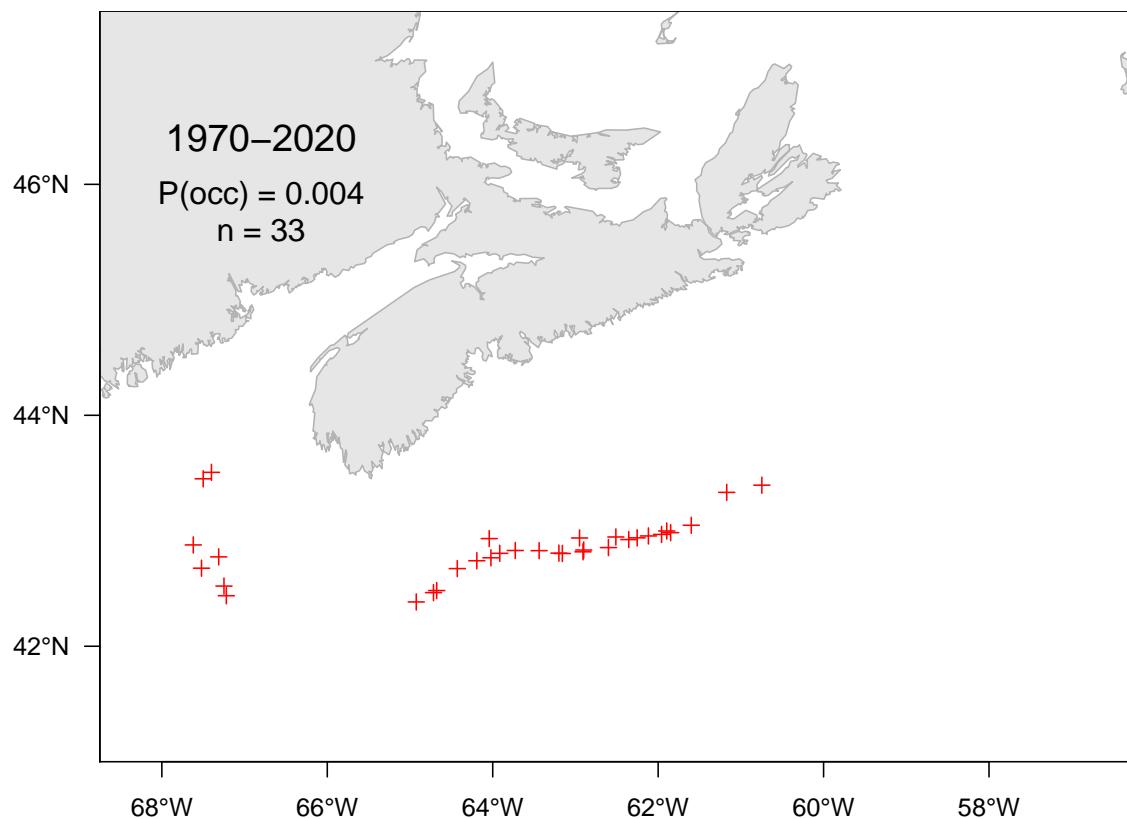


Figure 7.104A. Catch distribution for Red deepsea crab.

## INDEX

1202	Agone atlantique, 122	1248	Atlantic hookear sculpin, 131
1203	Agonidae, 161	1249	Atlantic king crab, 138
1204	Agonidae, 161	1250	Atlantic mackerel, 116
1205	Aspidophoroides monopterygius, 85	1251	Atlantic poacher, 122
1206	Leptagonus decagonus, 122	1252	Atlantic redfishes, 52
1207	Ulcina olrikii, 160	1253	Atlantic rock crab, 136
1208	Aiglefin, 37	1254	Atlantic saury, 181
1209	Aiguillat commun, 103	1255	Atlantic seasnail, 164
1210	Aiguillat noir, 185	1256	Atlantic soft pout, 178
1211	Alewife, 114	1257	Atlantic spiny lumpsucker, 125
1212	Alligatorfish, 85	1258	Atlantic tomcod, 143
1213	Alligatorfishes, 161	1259	Atlantic wolffish, 70
1214	Alosa pseudoharengus, 114	1260	Avocette ruban, 169
1215	Alosa sapidissima, 113	1261	Balaou atlantique, 181
1216	Alose savoureuse, 113	1262	Barndoor skate, 132
1217	Amblyraja radiata, 94	1263	Baudroie d'Amérique, 88
1218	American lobster, 141	1264	Black dogfish, 185
1219	American plaice, 58	1265	Blackbelly rosefish, 119
1220	American shad, 113	1266	Boa dragonfish, 155
1221	Ammodytes dubius, 126	1267	Brosme, 110
1222	Ammodytidae	1268	Brosme brosme, 110
1223	Ammodytes dubius, 126	1269	Brossé améthyste, 154
1224	Anarhichadidae	1270	Callionymidae
1225	Anarhichas denticulatus, 146	1271	Foetorepus agassizii, 176
1226	Anarhichas lupus, 70	1272	Calmar totam, 186
1227	Anarhichas minor, 145	1273	Cancer borealis, 135
1228	Anarhichas denticulatus, 146	1274	Cancer irroratus, 136
1229	Anarhichas lupus, 70	1275	Cancridae
1230	Anarhichas minor, 145	1276	Cancer borealis, 135
1231	Arctic alligatorfish, 160	1277	Cancer irroratus, 136
1232	Arctic eelpout, 177	1278	Capelan, 115
1233	Arctic hookear sculpin, 121	1279	Capelin, 115
1234	Arctic lyre crab, 137	1280	Cardeau à quatre ocelles, 149
1235	Arctozenus risso, 180	1281	Careproctus reinhardti, 167
1236	Argentina silus, 120	1282	Centroscyllium fabricii, 185
1237	Argentinidae	1283	Chabosseau bronzé, 157
1238	Argentina silus, 120	1284	Chabosseau à dix-huit épines, 76
1239	Artediellus atlanticus, 131	1285	Chabosseau à épines courtes, 156
1240	Artediellus uncinatus, 121	1286	Chaceon quinquedens, 187
1241	Aspidophoroides monopterygius, 85	1287	Chionoecetes opilio, 139
1242	Atlantic batfish, 183	1288	Chlorophthalmidae
1243	Atlantic butterfish, 130	1289	Chlorophthalmus agassizi, 153
1244	Atlantic cod, 34	1290	Parasudis truculenta, 151
1245	Atlantic hagfish, 109	1291	Chlorophthalmus agassizi, 153
1246	Atlantic halibut, 55		
1247	Atlantic herring, 73		

1292	Citharichthys arctifrons, 112	1338	Faux-trigle armé, 79
1293	Clupea harengus, 73	1339	Flétan de l'Atlantique, 55
1294	Clupeidae	1340	Flétan noir, 111
1295	Alosa pseudoharengus, 114	1341	Foetorepus agassizii, 176
1296	Alosa sapidissima, 113	1342	Fourbeard rockling, 118
1297	Clupea harengus, 73	1343	Fourline snakeblenny, 174
1298	Coryphaenoides rupestris, 163	1344	Fourspot flounder, 149
1299	Cotte polaire, 158		
1300	Cottidae	1345	Gadidae
1301	Artediellus atlanticus, 131	1346	Gadus morhua, 34
1302	Artediellus uncinatus, 121	1347	Melanogrammus aeglefinus, 37
1303	Icelus spatula, 159	1348	Microgadus tomcod, 143
1304	Myoxocephalus aenaeus, 157	1349	Pollachius virens, 49
1305	Myoxocephalus octodecemspinosis, 76	1350	Gadus morhua, 34
1306	Myoxocephalus scorpius, 156	1351	Gaspareau, 114
1307	Triglops murrayi, 79	1352	Gelatinous snailfish, 165
1308	Cottunculus microps, 158	1353	Geryonidae
1309	Crabe des neiges, 139	1354	Chaceon quinquedens, 187
1310	Crabe Hyas coarctatus, 137	1355	Glyptocephalus cynoglossus, 61
1311	Crabe lyre araignée, 140	1356	Goberge, 49
1312	Crabe rouge, 187	1357	Grande argentine, 120
1313	Crabe épineux du nord, 138	1358	Grande raie, 132
1314	Crevette nordique, 134	1359	Great spider crab, 140
1315	Cryptacanthodes maculatus, 175	1360	Greater argentine, 120
1316	Cryptacanthodidae	1361	Greenland halibut, 111
1317	Cryptacanthodes maculatus, 175	1362	Grenadier de roche, 163
1318	Cunner, 148	1363	Grenadier du Grand Banc, 123
1319	Cusk, 110	1364	Grenadier-scie, 162
1320	Cyclopteridae	1365	Grubby, 157
1321	Cyclopterus lumpus, 124	1366	Gulf Stream flounder, 112
1322	Eumicrotremus spinosus, 125		
1323	Cyclopterus lumpus, 124	1367	Haches d'argent, 182
1324	Cynoglossidae	1368	Haddock, 37
1325	Symphurus diomedeanus, 184	1369	Hameçon atlantique, 131
1326	Daubed shanny, 128	1370	Hameçon neigeux, 121
1327	Dibranchus atlanticus, 183	1371	Hareng de l'Atlantique, 73
1328	Dipturus laevis, 132	1372	Hatchetfishes, 182
1329	Doryteuthis pealeii, 186	1373	Helicolenus dactylopterus, 119
1330	Dragon-boa, 155	1374	Hemitripteridae
1331	Dragonnet tacheté, 176	1375	Hemitripterus americanus, 82
1332	Enchelyopus cimbrius, 118	1376	Hemitripterus americanus, 82
1333	Encornet rouge nordique, 106	1377	Hippoglossina oblonga, 149
1334	Etmopteridae	1378	Hippoglossoides platessoides, 58
1335	Centroscyllium fabricii, 185	1379	Hippoglossus hippoglossus, 55
1336	Eumesogrammus praecisus, 174	1380	Homard américain, 141
1337	Eumicrotremus spinosus, 125	1381	Homarus americanus, 141
		1382	Hyas araneus, 140
		1383	Hyas coarctatus, 137

1384	Hémitriptère atlantique, 82	1429	Loquette d'Amérique, 91
1385	<i>Icelus spatula</i> , 159	1430	<b>Lotidae</b>
1386	lcèle spatulée, 159	1431	<i>Brosme brosme</i> , 110
1387	<i>Illex illecebrosus</i> , 106	1432	<i>Enchelyopus cimbrius</i> , 118
1388	Jonah crab, 135	1433	Loup atlantique, 70
1389	<b>Labridae</b>	1434	Loup tacheté, 145
1390	<i>Tautogolabrus adspersus</i> , 148	1435	Loup à tête large, 146
1391	Lamproie marine, 142	1436	<i>Lumpenus lampretaeformis</i> , 127
1392	Langue fil noir, 184	1437	Lumpfish, 124
1393	Lanternfishes, 152	1438	Lussion blanc, 180
1394	Lançon, 126	1439	<i>Lycenchelys verrillii</i> , 168
1395	<i>Leptagonus decagonus</i> , 122	1440	Lycode arctique, 177
1396	<i>Leptoclinus maculatus</i> , 128	1441	Lycode du Labrador, 170, 171
1397	<i>Leucoraja erinacea</i> , 133	1442	Lycode à carreaux, 129
1398	<i>Leucoraja ocellata</i> , 100	1443	Lycode à tête longue, 168
1399	Limace atlantique, 164	1444	<i>Lycodes lavalaei</i> , 171
1400	Limace gélatineuse, 165	1445	<i>Lycodes reticulatus</i> , 177
1401	Limace marbée, 166	1446	<i>Lycodes terraenovae</i> , 170
1402	<i>Limanda ferruginea</i> , 64	1447	<i>Lycodes vahlii</i> , 129
1403	Limande à queue jaune, 64	1448	<b>Macrouridae</b>
1404	Limande-plie rouge, 67	1449	<i>Coryphaenoides rupestris</i> , 163
1405	<b>Liparidae</b>	1450	<i>Nezumia bairdii</i> , 123
1406	<i>Careproctus reinhardtii</i> , 167	1451	<i>Trachyrincus murrayi</i> , 162
1407	<i>Liparis atlanticus</i> , 164	1452	Malacoraja senta, 97
1408	<i>Liparis fabricii</i> , 165	1453	Mallotus villosus, 115
1409	<i>Liparis gibbus</i> , 166	1454	Malthe atlantique, 183
1410	<i>Liparis atlanticus</i> , 164	1455	Maquereau commun, 116
1411	<i>Liparis fabricii</i> , 165	1456	Marlin-spike grenadier, 123
1412	<i>Liparis gibbus</i> , 166	1457	Maurolicus muelleri, 154
1413	Lithodes maja, 138	1458	<i>Melanogrammus aeglefinus</i> , 37
1414	<b>Lithodidae</b>	1459	<i>Melanostigma atlanticum</i> , 178
1415	Lithodes maja, 138	1460	Merlu argenté, 46
1416	Little skate, 133	1461	Merlu argenté du large, 144
1417	<b>Loliginidae</b>	1462	<b>Merlucciidae</b>
1418	<i>Doryteuthis pealeii</i> , 186	1463	<i>Merluccius albidus</i> , 144
1419	Lompe, 124	1464	<i>Merluccius bilinearis</i> , 46
1420	Lompénie tachetée, 128	1465	<i>Merluccius albidus</i> , 144
1421	Lompénie-serpent, 127	1466	<i>Merluccius bilinearis</i> , 46
1422	Longfin hake, 117	1467	Merluche blanche, 40
1423	Longfin inshore squid, 186	1468	Merluche à longues nageoires, 117
1424	Longhorn sculpin, 76	1469	Merluche écureuil, 43
1425	Longnose greeneye, 151	1470	<i>Microgadus tomcod</i> , 143
1426	<b>Lophiidae</b>	1471	Molasse atlantique, 178
1427	<i>Lophius americanus</i> , 88	1472	Monkfish, 88
1428	<i>Lophius americanus</i> , 88	1473	Morue franche, 34
		1474	Motelle à quatre barbillons, 118
		1475	Moustache sculpin, 79

1476	Myctophidae, 152	1521	Petite poule de mer atlantique, 125
1477	Myctophidae, 152	1522	Petromyzon marinus, 142
1478	Myoxocephalus aenaeus, 157	1523	Petromyzontidae
1479	Myoxocephalus octodecemspinulosus, 76	1524	Petromyzon marinus, 142
1480	Myoxocephalus scorpius, 156	1525	Pholidae
1481	Myxine du nord, 109	1526	Pholis gunnellus, 172
1482	Myxine glutinosa, 109	1527	Pholis gunnellus, 172
1483	Myxinidae	1528	Phycidae
1484	Myxine glutinosa, 109	1529	Phycis chesteri, 117
1485	Nemichthyidae	1530	Urophycis chuss, 43
1486	Nemichthys scolopaceus, 169	1531	Urophycis tenuis, 40
1487	Nemichthys scolopaceus, 169	1532	Phycis chesteri, 117
1488	Nephropidae	1533	Picked dogfish, 103
1489	Homarus americanus, 141	1534	Pleuronectidae
1490	Newfoundland eelpout, 170, 171	1535	Glyptocephalus cynoglossus, 61
1491	Nezumia bairdii, 123	1536	Hippoglossoides platessoides, 58
1492	Northern prawn, 134	1537	Hippoglossus hippoglossus, 55
1493	Northern shortfin squid, 106	1538	Limanda ferruginea, 64
1494	Northern wolffish, 146	1539	Pseudopleuronectes americanus, 67
1495	Ocean pout, 91	1540	Reinhardtius hippoglossoides, 111
1496	Oeil-vert à long nez, 151	1541	Plie canadienne, 58
1497	Offshore silver hake, 144	1542	Plie du Gulf Stream, 112
1498	Ogcocephalidae	1543	Plie grise, 61
1499	Dibranchus atlanticus, 183	1544	Poisson-alligator arctique, 160
1500	Ommastrephidae	1545	Poisson-alligator atlantique, 85
1501	Illex illecebrosus, 106	1546	Poissons-alligator, 161
1502	Oregoniidae	1547	Poissons-lanternes, 152
1503	Chionoecetes opilio, 139	1548	Polar sculpin, 158
1504	Hyas araneus, 140	1549	Pollachius virens, 49
1505	Hyas coarctatus, 137	1550	Pollock, 49
1506	Osmeridae	1551	Poulamon atlantique, 143
1507	Mallotus villosus, 115	1552	Pseudopleuronectes americanus, 67
1508	Osmerus mordax, 147	1553	Psychrolutidae
1509	Osmerus mordax, 147	1554	Cottunculus microps, 158
1510	Pandalidae	1555	Quatre-lignes atlantique, 174
1511	Pandalus borealis, 134	1556	Queen crab, 139
1512	Pandalus borealis, 134	1557	Radiated shanny, 173
1513	Paralepididae	1558	Raie hérisson, 133
1514	Arctozenus risso, 180	1559	Raie lisse, 97
1515	Paralichthyidae	1560	Raie tachetée, 100
1516	Citharichthys arctifrons, 112	1561	Raie épineuse, 94
1517	Hippoglossina oblonga, 149	1562	Rainbow smelt, 147
1518	Parasudis triculenta, 151	1563	Rajidae
1519	Peprilus triacanthus, 130	1564	Amblyraja radiata, 94
1520	Petite limace de mer, 167	1565	Dipturus laevis, 132
		1566	Leucoraja erinacea, 133

1567	Leucoraja ocellata, 100	1614	Leptoclinus maculatus, 128
1568	Malacoraja senta, 97	1615	Lumpenus lampretaeformis, 127
1569	Red deepsea crab, 187	1616	Ulvaria subbifurcata, 173
1570	Red hake, 43	1617	Stomias boa, 155
1571	Reinhardtius hippoglossoides, 111	1618	Stomiidae
1572	Rock gunnel, 172	1619	Stomias boa, 155
1573	Roughnose grenadier, 162	1620	Stromateidae
1574	Roundnose grenadier, 163	1621	Peprilus triacanthus, 130
1575	Saint Pierre argenté, 179	1622	Stromaté fossette, 130
1576	Sand lance, 126	1623	Syphurus diomedeanus, 184
1577	Scomber scombrus, 116	1624	Sébaste chèvre, 119
1578	Scomberesocidae	1625	Sébastes de l'Atlantique, 52
1579	Scomberesox saurus, 181	1626	Tanche-tautogue, 148
1580	Scomberesox saurus, 181	1627	Tautogolabrus adspersus, 148
1581	Scombridae	1628	Terrassier tacheté, 175
1582	Scomber scombrus, 116	1629	Thorny skate, 94
1583	Scophthalmidae	1630	Tourteau jona, 135
1584	Scophthalmus aquosus, 150	1631	Tourteau poïnclos, 136
1585	Scophthalmus aquosus, 150	1632	Trachyrincus murrayi, 162
1586	Sea lamprey, 142	1633	Triglops murrayi, 79
1587	Sea raven, 82	1634	Turbot de sable, 150
1588	Sea tadpole, 167		
1589	Sebastes, 52	1635	Ulcina olrikii, 160
1590	Sebastidae	1636	Ulvaire deux-lignes, 173
1591	Helicolenus dactylopterus, 119	1637	Ulvaria subbifurcata, 173
1592	Sebastes, 52	1638	Urophycis chuss, 43
1593	Shorthorn sculpin, 156	1639	Urophycis tenuis, 40
1594	Shortnose greeneye, 153		Vahl's eelpout, 129
1595	Sigouine de roche, 172	1640	Variegated snailfish, 166
1596	Silver hake, 46	1641	
1597	Silvery John dory, 179	1642	White barracudina, 180
1598	Silvery lightfish, 154	1643	White hake, 40
1599	Slender snipe eel, 169	1644	Windowpane flounder, 150
1600	Smooth skate, 97	1645	Winter flounder, 67
1601	Snakeblenny, 127	1646	Winter skate, 100
1602	Spatulate sculpin, 159	1647	Witch flounder, 61
1603	Spotfin dragonet, 176	1648	Wolf eelpout, 168
1604	Spotted wolffish, 145	1649	Wrymouth, 175
1605	Spottedfin tonguefish, 184		Yellowtail flounder, 64
1606	Squalidae	1650	
1607	Squalus acanthias, 103	1651	Zeidae
1608	Squalus acanthias, 103	1652	Zenopsis conchifer, 179
1609	Sternopychidae, 182	1653	Zenopsis conchifer, 179
1610	Maurolicus muelleri, 154	1654	Zoarces americanus, 91
1611	Sternopychidae, 182	1655	Zoarcidae
1612	Stichaeidae	1656	Lycenchelys verrillii, 168
1613	Eumesogrammus praecisus, 174		

- 1657      *Lycodes lavalaei*, 171
  - 1658      *Lycodes reticulatus*, 177
  - 1659      *Lycodes terraenovae*, 170
  - 1660      *Lycodes vahlii*, 129
  - 1661      *Melanostigma atlanticum*, 178
  - 1662      *Zoarces americanus*, 91
- 
- 1663      Éperlan arc-en-ciel, 147
  - 1664      Éperlan du large, 153